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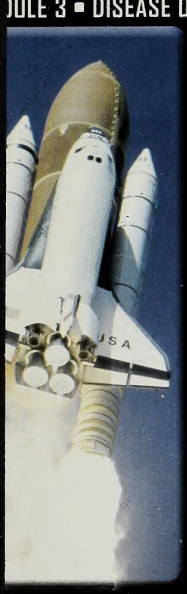

SCIENCE 24

MODULE 3 • DISEASE DEFENCE AND HUMAN HEALTH

Learning Technologies Branch

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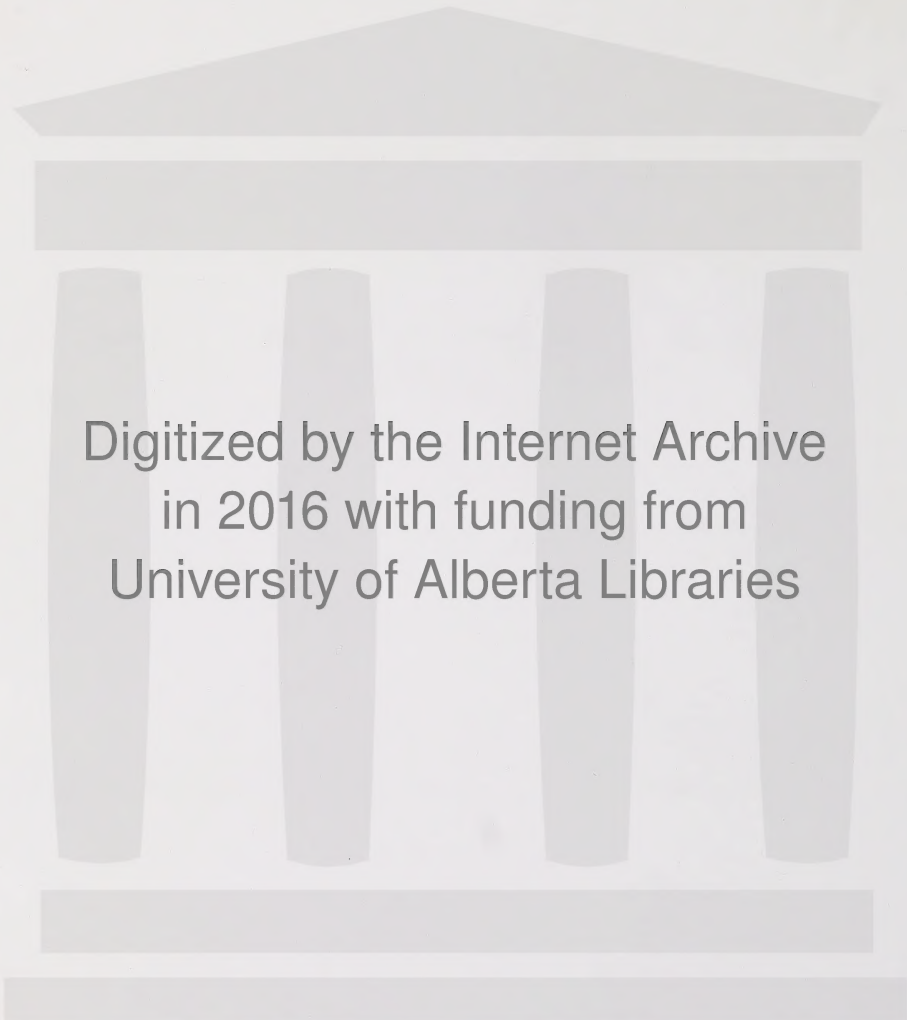
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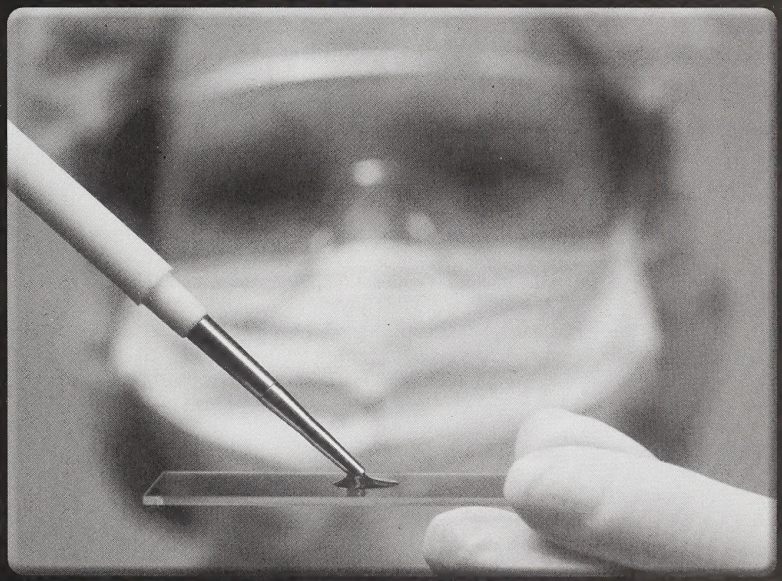
SCIENCE 24

MODULE 3 ■ DISEASE DEFENCE AND HUMAN HEALTH



Science 24
Module 3: Disease Defence and Human Health
Student Module Booklet
Learning Technologies Branch
ISBN 0-7741-2604-3

The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Student Module Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

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- Alberta Learning, **http://www.learning.gov.ab.ca**
- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.learning.gov.ab.ca**

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Welcome to

SCIENCE 24

Module Three

Science 24 contains four modules.
You should work through the modules in order (from 1 to 4) because concepts and skills introduced in one module will be reinforced, extended, and applied in later modules.

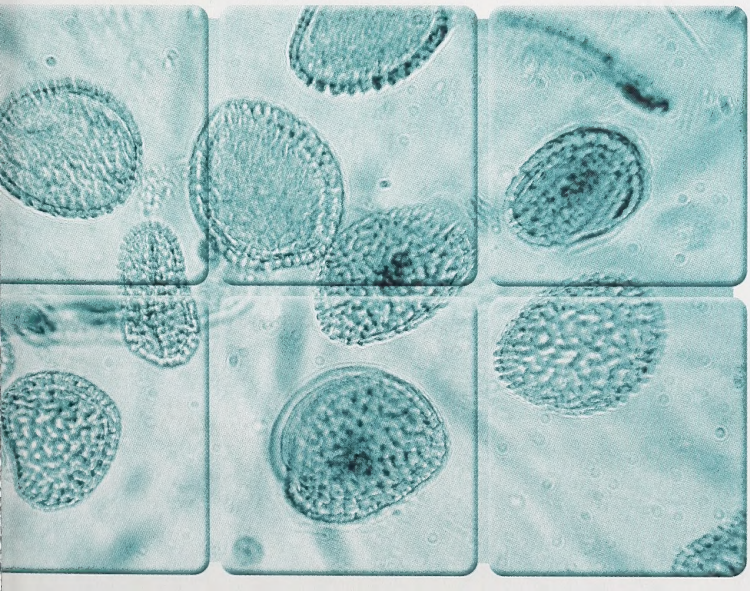
Module 1 contains general information about the course, course components, resources, assessment and feedback, and visual cues. If you do not have access to Module 1, contact your teacher to obtain this important information.

MODULE 1
■ MATTER AND CHEMICAL CHANGE ■

MODULE 2
■ ENERGY TRANSFORMATIONS ■

MODULE 3
■ DISEASE DEFENCE AND HUMAN HEALTH ■

MODULE 4
■ SAFETY IN TRANSPORTATION ■



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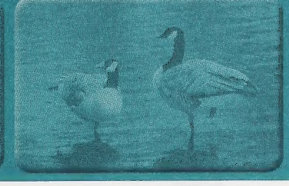

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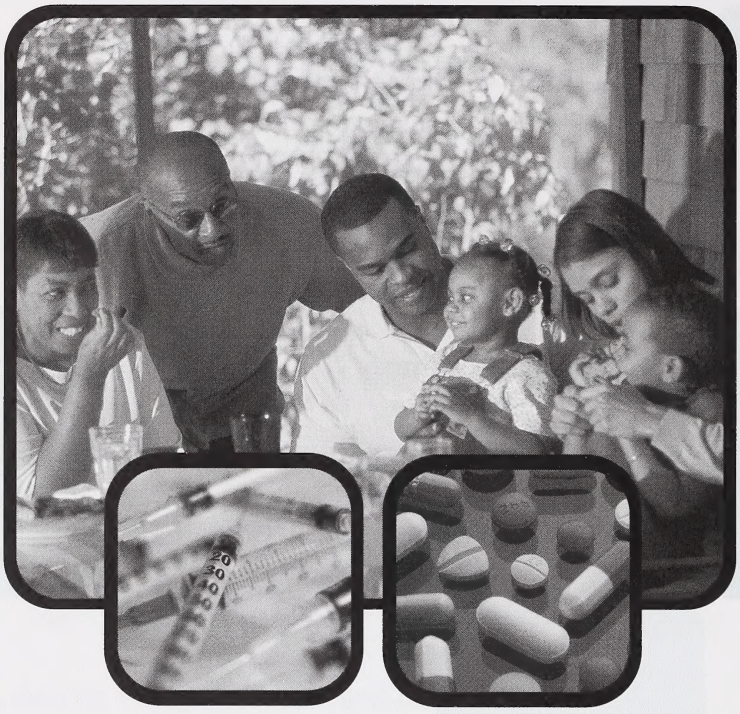
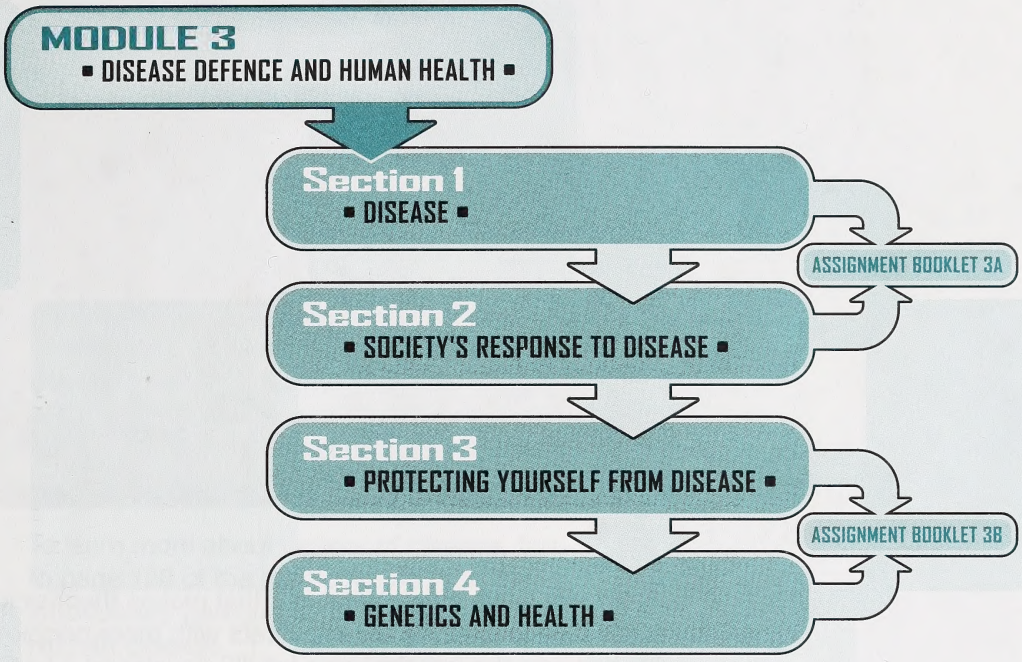
Module Overview



Did you know that, today, you are expected to live longer than your great-grandparents or even your grandparents? Over the past 100 years, life expectancy has been increasing. Many people 100 years ago died of various diseases, such as influenza, tuberculosis, scarlet fever, and polio, because many antibiotics and vaccines were not available.

What caused these diseases and how did they spread? How does your body protect itself from disease? What characteristics do you inherit from your parents that affect your health? What effect does your environment have on your health?

In this module you will find the answers to these questions and more. You will identify the causes of some diseases and discover how they spread. You will learn about antibiotics used to treat disease and examine disease preventions, such as immunizations and cleanliness. You will also discover how certain characteristics passed from parent to child can make the child prone to particular diseases.

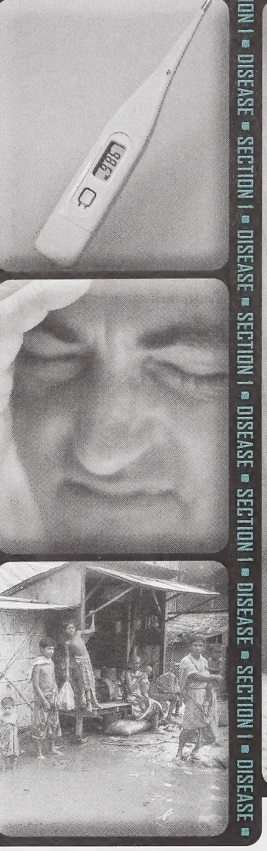


Assessment

This module, Disease Defence and Human Health, has four section assignments. The mark distribution is as follows:

Assignment Booklet 3A	
Section 1 Assignment	28 marks
Section 2 Assignment	18 marks
Assignment Booklet 3B	
Section 3 Assignment	31 marks
Section 4 Assignment	23 marks
Total	**100 marks**

Warning: This module, particularly Section 2, provides a discussion of various aspects of HIV/AIDS, including its prevention and transmission. In Section 2, Activity 1, you have the option of choosing an alternative investigation in Investigation 10-A.



Section 1

DISEASE

Children seem to get sick quite often. What is it that makes them sick more often than others? Is it because they are in contact with more people each day than adults are? When was the last time you felt ill? developed a headache, fever, or a cough? When you cough, do you make sure you cover your mouth? Do you avoid coming in contact with other people when you have a cold or flu?

Did you know that some diseases can be passed on to others through airborne germs? through food? through contact? through bodily fluids?

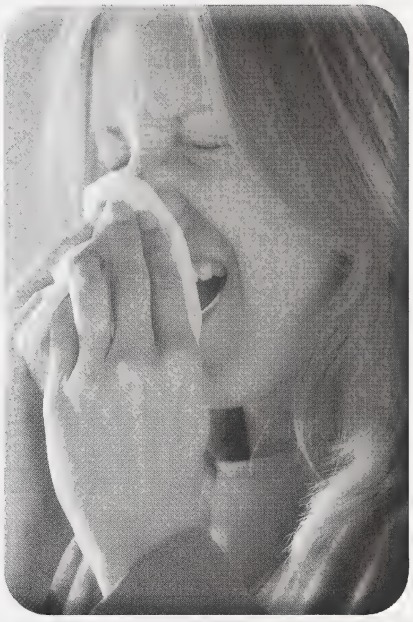
In this section you will identify what causes disease in humans and study how diseases spread. You will then describe the difference between communicable and non-comunicable diseases. You will also learn how to safely handle food and identify techniques used to kill germs.

Turn to pages 156 and 157 of the textbook. Read the introductory paragraphs of "Chapter 9: Disease." Check out the points in "What You Will Learn," "Why It Is Important," and "Skills You Will Use" on page 157. These will give you a quick overview of what you will cover in this section.

Lesson 1

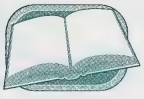
Causes of Human Disease

When you get a cold or the flu, do you wonder how you caught that cold or flu? Do you try staying away from others whom you know have a cold or flu?



Diseases are caused by microbes called **pathogens**. Before the invention of the microscope, diseases were thought to be caused by various spirits. With the invention of the microscope, scientists were able to identify various micro-organisms and link them to specific diseases.

pathogen: any of a number of disease-causing agents or microbes



To learn more about causes of disease, turn to page 158 of the textbook and read the introductory paragraphs of "Causes of Human Disease."

1. Define *disease*.
2. What are three causes of disease other than pathogens?
3. Name three places where pathogens may live.
4. How can pathogens be reduced or kept in check?
5. What technique, still used today, did Louis Pasteur discover?

Check your answers on page 84 of the Appendix.

Pathogens include a number of disease-causing microbes, some of which you are most likely already familiar with. Turn to page 159 of the textbook and read "Pathogens," "Bacteria," and "Viruses."

6. Name four pathogens.

7. Are all bacteria harmful? Give an example of a bacterium that is beneficial.

8. List three conditions that cause bacteria to reproduce quickly.

9. How can you slow bacterial growth on fresh meat?

10. How do viruses multiply?

11. What does the HIV virus that causes AIDS look like?

12. List four ways in which an uninfected person can be contaminated with HIV.

Check your answers on page 84 of the Appendix.

You saw that warm temperatures, moisture, and food are required for bacterial growth. In the next investigation you will test these three conditions for bacterial growth.

Investigation

9-A: Conditions for Growth of Bacteria

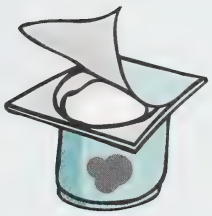
Turn to pages 160 and 161 of the textbook and read the entire investigation.

If you have access to a laboratory facility, do **Part A**. If you do not have access to a laboratory facility, do **Part B**.

Note: Students who complete Part A may also complete Part B for additional information on bacteria.

Part A

Follow the instructions in the procedure carefully. **Pay particular attention to the safety precautions mentioned. Remember, do not eat anything that has been produced in a science lab.**



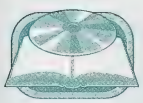
13. Answer the following on page 161 of the textbook.

    a. questions 1 and 2 of "Analyze"

    b. questions 3 to 7 of "Conclude and Apply"

Check your answers on page 85 of the Appendix.

Part B



Insert the *Science.Connect 2 Student Multimedia* CD into your computer. Launch the "Bacteria" applet to study the conditions for growth of bacteria. Starting with Part 1: Ring Around the Rosies, follow the instructions to complete the first six parts of the applet.

14. How is the rhyme "Ring Around the Rosies" related to the bubonic plague?

15. a. Which nutrient is used to grow bacteria?

    b. How many bacteria grow in a single colony in a petri dish?

16. a. Name five places mentioned in the applet where bacteria exist.

    b. Where does the tetanus bacteria live?

    c. How is bacteria used to extract gold in Australia?

17. a. What does the bacterium *Lactobacillus acidophilus* do to milk and yogurt?

    b. Which bacteria may be present in chicken?

    c. How can you prevent the bacteria that may be present in chicken from causing you harm?

18. a. List the ways in which bacteria can be beneficial.

    b. List the ways in which bacteria can be harmful.

19. a. How often do bacteria divide?

    b. How long did it take the E. coli bacteria to fill the petri dish?

20. a. What types of bacteria were grown in Investigation 1: Growing Bacteria (Part 6)?

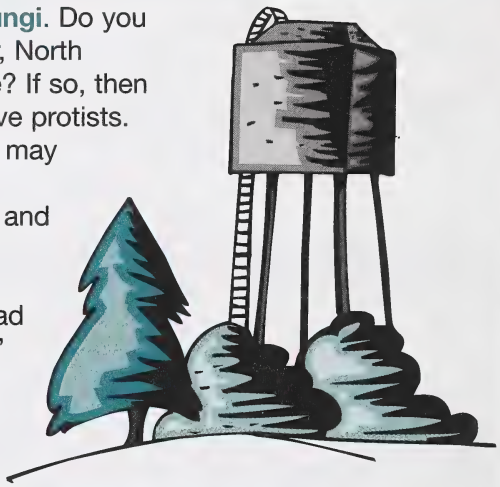
    b. Why was the incubator used in Investigation 1: Growing Bacteria?

Check your answers on pages 85 and 86 of the Appendix.

protist: a single-celled organism that has characteristics of both plants and animals

fungi: parasites that include moulds, yeasts, and mushrooms

Other pathogens include **protists** and **fungi**. Do you recall news items regarding beaver fever, North Battleford's water problems, or Red Tide? If so, then you are familiar with problems that involve protists. Protists are single-celled organisms that may cause intestinal problems as well as a number of diseases. Fungi are parasites and require a host to live on.



Turn to page 162 of the textbook and read the information in "Protists" and "Fungi." Answer the following questions.

21. a. Name two common protists.

    b. List three serious diseases caused by protists.

22. a. Name the protist that causes beaver fever.

    b. How can you avoid beaver fever?

23. a. Why do fungi live on a host?

    b. Which fungi do people eat?

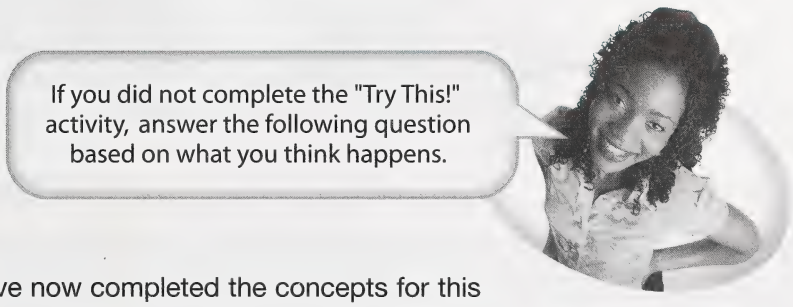
    c. Name two skin diseases caused by fungi that live on the human body.

Check your answers on pages 86 and 87 of the Appendix.

If you can obtain yeast and a balloon, complete "Try This!" on page 162 of the textbook. Blow up the balloon a number of times before doing this activity.

24. What happens to the balloon? Explain.

Check your answer on page 87 of the Appendix.



You have now completed the concepts for this lesson. Do the following questions to review what you studied.

25. Answer questions 1 and 4 of "Check Your Understanding" on page 162 of the textbook.

Check your answers on page 87 of the Appendix.

Go to pages 1 and 2 of Assignment Booklet 3A and answer questions 1 to 5.

Lesson 2

Communicable and Non-Communicable Diseases

Have you had a cold or the flu lately? Did you catch it from someone? Why is it that you can catch a cold from another person but not a heart condition, or diabetes, or cancer?

How do germs spread? The following activity provides a simulation of how germs can spread.

Starting Point Activity

Spreading Microbes

Turn to page 157 of the textbook and read the entire activity.

If you have access to a supervised laboratory, do **Part A**. If you do not have access to a supervised laboratory, do **Part B**.

Part A

Follow the instructions outlined in "What to Do." **Pay careful attention to the safety precautions mentioned.**

1. Complete the table in step 2 of "What to Do" using the results from your activity.

2. One of the three unknown solutions contains a virus. Use the information in your chart to predict which unknown solution contains the virus. Explain how you know which solution contains the virus.

Check your answers on page 88 of the Appendix.

Part B

In this activity a student had three unknown solutions and a germ indicator solution. The student made three combinations of the unknown solutions and added a few drops of a germ indicator solution to each combination. The student then recorded the results in the following table.

Unknown Solutions	Colour Before Germ Indicator	Colour After Germ Indicator
#1 and #2	clear	pink
#1 and #3	clear	clear
#2 and #3	clear	pink

Use this table to answer question 2 in Part A.

communicable disease: a disease that can be passed from one organism to another

non-communicable disease: a disease that cannot be passed from one organism to another

Diseases that can be passed from one organism to another are called **communicable diseases**. Diseases that cannot be passed from one organism to another are called **non-communicable diseases**.

Turn to page 163 of the textbook and read the introductory information in "Communicable and Non-Communicable Diseases." Pay particular attention to Table 9.1.

3. What is a communicable disease?

4. What is a non-communicable disease?

5. How is a communicable disease different from a non-communicable disease?

6. What are four methods through which communicable diseases can spread?

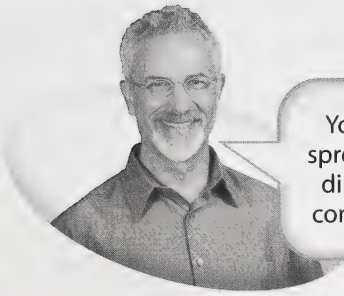
7. a. How do botulism and salmonella spread?

   b. What are the effects of botulism and salmonella?

8. a. How does meningitis spread?

   b. What are the effects of meningitis?

Check your answers on page 88 of the Appendix.



You just learned that communicable diseases can spread through the air, in water, in food, and through direct contact. How can the chances of catching a communicable disease be minimized or prevented?

Turn to page 164 of the textbook and read "The Importance of a Clean Environment."

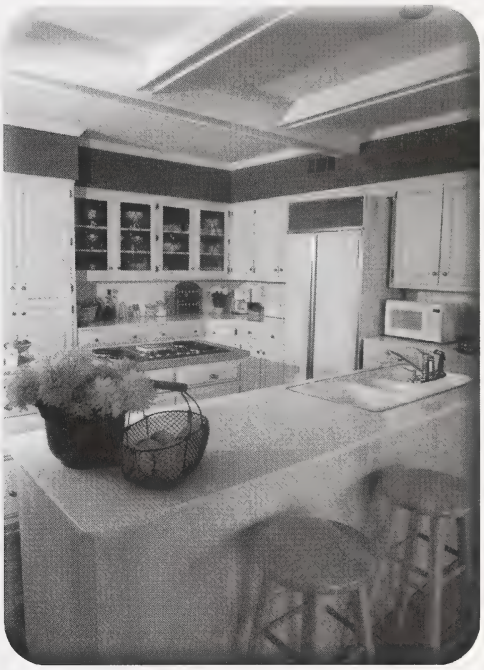
9. How does a clean environment prevent the spread of communicable diseases?

10. Why do bathrooms, especially, have to be kept clean?

11. In which occupations do people need to take special precautions in their work?

12. What is food poisoning?

13. Name one meat that needs special care when handling and preparing.

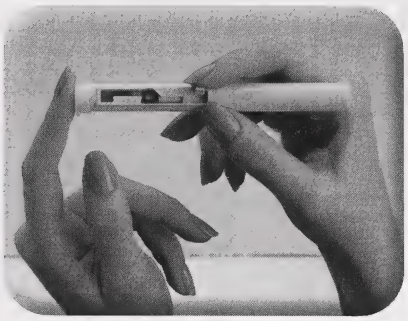


CHECK

Check your answers on pages 89 of the Appendix.

If you have access to the Internet or recently published reference books, you may complete "Find Out Activity: Disease Wanted—Dead or Alive!" on page 164 of the textbook. Once you have chosen the pathogen you wish to research, enter the pathogen name, such as *anthrax*, into any of the Internet's search engines to find many informative websites. Use the information you obtain to answer the questions posed in "What to Do."

Non-communicable diseases, unlike communicable diseases, are not spread by pathogens. Some examples of non-communicable diseases include diabetes, heart disease, emphysema, and cystic fibrosis. How does a person get a non-communicable disease?



Read "How Do You Get a Non-Communicable Disease?" on page 165 of the textbook. Examine Figures 9.7 to 9.10 closely.

14. Answer the question posed in "Reading Check" on page 165 of the textbook.

15. Which disease can result from polluted air?

16. Which disease can result from a diet high in fat and cholesterol?

17. Which conditions may result from being overweight?

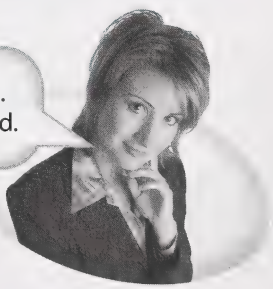
18. What factor is associated with diseases like cystic fibrosis?

19. Approximately how many children in Canada go to school hungry?

20. What problems are associated with malnourished children?

Check your answers on page 89 of the Appendix.

You have just completed the concepts for this lesson. Do the following questions to review what you studied.



21. Answer questions 1 and 2 of "Check Your Understanding" on page 165 of the textbook.

Check your answers on page 89 of the Appendix.

Go to page 2 of Assignment Booklet 3A and answer questions 6 to 9.

Lesson 3

Who Is Most Likely to Get Sick?

How often do you catch a cold or the flu? Are others in your family healthy most of the time? In some countries, poverty is an everyday part of life. People do not have adequate shelter or enough food or medicine. People who live in poverty have a much higher risk of contracting a communicable disease.

Turn to page 166 of the textbook and read the introductory paragraphs of "Who Is Most Likely to Get Sick?" Then continue on by reading "What Are Your Risk Factors?" on pages 166 and 167. Study Table 9.2 at the top of page 167 closely.

1. How does the life expectancy of the average Canadian compare with the life expectancy of the average person in Sierra Leone?

2. Why is the life expectancy of the average Canadian so much higher than that of the average person in Sierra Leone?

3. a. What percentage of people in Sierra Leone die from communicable diseases?

   b. How does this percentage compare to the percentage of people in Canada who die from communicable diseases?

4. The percentage of people who die from non-communicable diseases in Canada is almost twice that of Sierra Leone. Does this mean the health of the people in Canada is poorer than the health of the people in Sierra Leone? Explain.

5. What are risk factors?

6. Are the types of risk factors different for people in Canada than for people in Sierra Leone?

7. Write out possible diseases for each of the following risk factors.

   a. not eating properly b. not having a toilet c. smoking tobacco

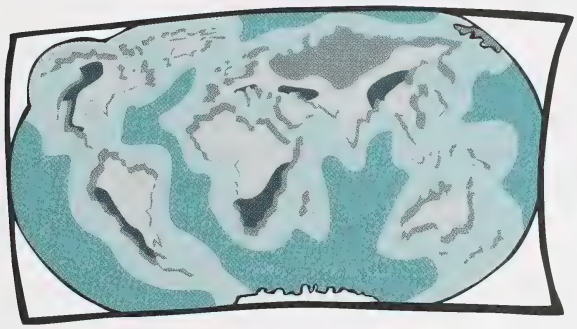
8. What is the source of risk for each of the following risk factors?

   a. drinking unclean water

   b. not practising personal hygiene, such as washing hands frequently

   c. consuming excess alcohol

9. Read "Did You Know?" on page 166 of the textbook. **Note:** In 2003 the world population was approximately 6.3 billion.



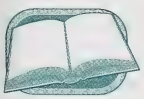
   a. What percentage of people lack clean water?

   b. What percentage of people lack toilets?

10. Study Figure 9.12 on page 167 of the textbook. When might people in Canada be at risk of contracting a communicable disease associated with the risk factor of drinking unclean water? Explain.

Check your answers on pages 90 and 91 of the Appendix.

You have now completed the concepts for this lesson.
Do the following questions to review what you covered.



11. Answer questions 1, 3, and 4 of "Check Your Understanding" on page 167 of the textbook.

Check your answers on page 91 of the Appendix.

Go to pages 3 and 4 of Assignment Booklet 3A and answer questions 10 to 13.

Lesson 4

Stop Disease in Its Tracks

Next time you are in a restaurant and are able to take a tour of the kitchen, take note of what the chefs are wearing. Are they wearing rubber gloves? Are they wearing hats? hair nets? Today, those who handle food in most restaurants, hotels, and fast-food chains wear rubber gloves to protect you and themselves from disease.

Each year, a few cases of food poisoning and contamination of meats in stores occur. Turn to page 168 of the textbook and read "Preventing Food Poisoning" and "Food Preservation." Study Table 9.3 closely.

1. Name the bacteria that causes food poisoning through coughing or handling food with poor hygiene.
2. What can food handlers wear to prevent the spread of staph bacteria?
3. Why is botulism such a serious type of food poisoning?
4. What is the purpose of food preservation?
5. Describe the process involved in the following food preservation methods. What makes each method effective?

   a. smoking or drying food
   b. salting food
   c. vacuum packing
   d. irradiation

6. Write a short report describing the methods Aboriginal peoples in western Canada used to preserve food 150 years ago. Use the Internet to find information, or visit your local library.

Check your answers on pages 91 and 92 of the Appendix.

Investigation

9-B: Let's Go on a Picnic!

Turn to page 169 of the textbook and read the entire investigation.

Follow the instructions in "What to Do" carefully to complete the investigation. You may find the following websites useful:

- **http://www.fightbac.org/10least.cfm**
- **http://www.fightbac.org/summer_fact.cfm**

7. Copy and complete a table similar to the following. Parts of the table have been done for you.

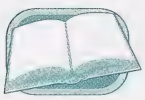
Food	How to Prepare	How to Keep Safe	Type of Food Poisoning Possible
chicken wraps	• Prepare chicken on its own cutting board. • Cook chicken thoroughly. • Cool and refrigerate. • Wash thoroughly after use.	• *Pack in cooler with ice pack.* • *Choose a shady spot for the picnic.* • *Do not leave out in hot weather for more than 1 hour.*	*salmonella*
coleslaw with dressing			samonella or staph bacteria
homemade canned black-bean salsa	• Keep in sealed container until ready to use.		botulism
coconut cream pie	• Prepare in clean work area. • Keep refrigerated.		

lemonade			none
fresh strawberries			none, but could grow mould after a day or two

8. Answer textbook questions 1 and 2 of "Analyze."

Check your answers on pages 92 to 94 of the Appendix.

Food preparation is not the only area where you have to be concerned with bacteria growth. Hospitals need to keep all areas clean and germ free, since patients may have a lower resistance to diseases or may have breaks in the skin from injuries or surgery.



Turn to page 170 of the textbook and read "Keeping Hospitals Healthy" and "Aseptic Methods."

9. Why did many people who went into hospitals 200 years ago die?

10. What did Florence Nightingale do that reduced the death rate in hospitals?

11. What did Joseph Lister do to reduce the risk of infection during surgeries?

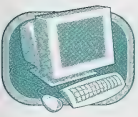
12. Modern hospitals keep rooms and equipment aseptic. What does this mean?

13. List three aseptic practices.

14. Name four common disinfectants.

15. In what part of the world did people first recognize the need for cleanliness in hospitals?

Check your answers on page 94 of the Appendix.



The first "Try This!" section on page 170 of the textbook refers to a disinfectant called triclosin. Actually, the word is **triclosan**. Research the use of triclosan on the Internet or at your local library.

16. What problems are associated with the extensive use of triclosan?

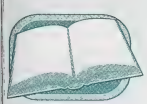
Check your answer on pages 94 of the Appendix.

If you have access to a supervised laboratory with a microscope, you may wish to complete the activity in the second "Try This!" on page 170 of the textbook.

Today, there are many antiseptics and disinfectants available for purchase. How effective are these antiseptics and disinfectants? The next investigation will help you determine how effective some products are in killing microbes.

Investigation

9-C: Do Antiseptics and Disinfectants Kill Microbes?



Turn to page 171 of the textbook and read the entire investigation.

17. Write out a procedure to complete the investigation.

Check your answer on pages 95 of the Appendix.

If you have access to a supervised laboratory, do **Part A**. If you do not have access to a supervised laboratory, do **Part B**.

Part A

Follow the instructions in "Design Criteria" and "Plan and Construct" to complete the investigation. **Pay special attention to the safety precautions mentioned, and read the HHPS labels on all the products.**

Here is the list of materials and apparatus you will need for this investigation:

- 8 test tubes (13 mL)
- test tube rack
- 9 medicine droppers
- stirring rod
- 50-mL beaker
- compound microscope
- microscope slides
- slip covers
- 20 mL of yeast solution
- 5 mL of methylene blue indicator
- 1 mL of toothpaste
- 1 mL of mouthwash
- 1 mL of hydrogen peroxide
- 1 mL of rubbing alcohol
- 1 mL of bleach
- 1 mL of antibacterial soap solution
- 1 mL of baking soda
- 1 mL of water

18. Copy and complete a table similar to the following.

Product Tested	No Microbes Killed	Few Microbes Killed	Many Microbes Killed
toothpaste			
mouthwash			
hydrogen peroxide			
rubbing alcohol			
bleach			
antibacterial soap			
baking soda			
water			

19. List the products in order of effectiveness at killing microbes.

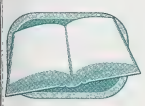
Check your answers on pages 95 and 96 of the Appendix.

Part B

A student performed this investigation and obtained the following results. Use these results to answer question 19.

Product Tested	No Microbes Killed	Few Microbes Killed	Many Microbes Killed
toothpaste		✓	
mouthwash			✓
hydrogen peroxide			✓
rubbing alcohol			✓
bleach			✓
antibacterial soap			✓
baking soda	✓		
water	✓		

You have now completed the concepts for this lesson. Review what you covered by answering the following questions.

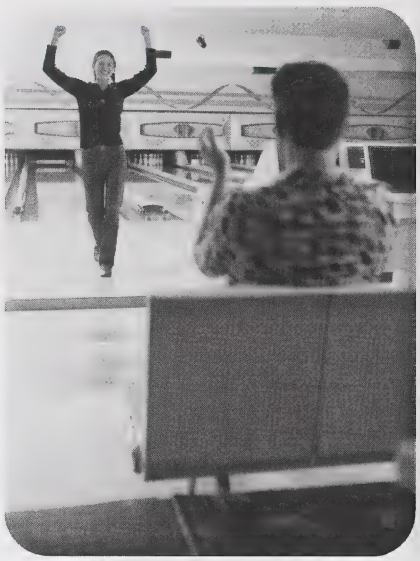


20. Answer questions 2 and 3 of "Check Your Understanding" on page 171 of the textbook.

Check your answers on page 96 of the Appendix.

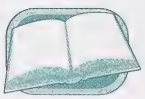
Go to pages 4 and 5 of Assignment Booklet 3A and answer questions 14 to 18.

Section 1 Review



In this section you identified what causes disease in humans and described how diseases spread. You compared communicable and non-communicable diseases and analyzed the difference between these two types of diseases. You examined how to handle food safely and identified techniques used to kill germs. You then compared the effectiveness of a number of antiseptics and disinfectants.

The knowledge you gained about how diseases spread should help you avoid passing disease pathogens on to others. What you learned about antiseptics and disinfectants should help you avoid catching a cold or flu and help you avoid food poisoning caused by unsanitary food handling. You can apply what you learned to living a healthier life.



You have now completed the concepts for this section. To review what you covered, answer the following "Chapter 9 Review" questions on pages 172 and 173 of the textbook. If necessary, go back and read over parts of this section as you answer the questions.

1. Answer question 1 of "Reviewing Key Terms."
2. Answer questions 3, 4, and 9.a. of "Understanding Key Ideas."
3. Answer question 11 of "Developing Skills."
4. Answer question 12 of "Problem Solving/Applying."
5. Answer question 16 of "Critical Thinking."

Check your answers on pages 96 and 97 of the Appendix.

SOCIETY'S RESPONSE TO DISEASE

Do you recall the SARS outbreak in Toronto in the spring of 2003? What did the medical staff at Toronto hospitals do? How did the public respond? Although we may think that outbreaks of influenza are a thing of the past, SARS reminded us that new diseases can occur.

In this section you will identify widespread diseases and how they affect society. You will then analyze the importance of health programs and good personal hygiene. You will describe how public health guidelines help maintain the health of a community and how individuals maintain personal and public health.

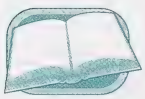
Turn to pages 174 and 175 of the textbook and read the introduction to "Chapter 10: Society's Response to Disease." Check out the points outlined in "What You Will Learn," "Why It Is Important," and "Skills You Will Use." These points give you a quick overview of what you will cover in this section.

Lesson 1

How Diseases Affect Society

Every so often a new disease occurs that is widespread and affects a large portion of the population. Examples of such diseases are the bubonic plague, tuberculosis, Spanish flu, and AIDS. These diseases, which are widespread and difficult to control, are called **pandemics**. Diseases that are widespread but not as difficult to control are called **epidemics**. Whether it be a pandemic or an epidemic, the results usually end up the same—death to many people.

pandemic: an outbreak of a disease that is widespread, affects a large portion of the population, and is difficult to control



Turn to page 176 of the textbook and read "How Diseases Affect Society."

epidemic: an outbreak of a disease that spreads quickly through a population but is not as widespread as a pandemic

1. What diseases did Europeans bring to North America that affected the Aboriginal population?

2. Why did these diseases affect Aboriginal society so much?

3. List three effects of these diseases on Aboriginal society.

4. Which disease is affecting a significant part of African society as well as many other societies today?

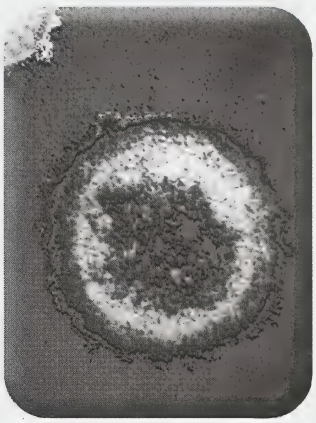
5. How have historians learned about diseases that were widespread in the past?

6. How did a large number of Aboriginals die when a British general used a form of biological warfare in the 1700s?

Check your answers on pages 97 and 98 of the Appendix.

Investigation

10-A: AIDS and the Law



Microscopic View of AIDS Virus

In this investigation you will research how AIDS spreads as well as find information regarding those who knowingly spread the AIDS virus. You will then form an opinion about whether people who knowingly spread the AIDS virus should be charged with a criminal offence.

If you wish to research this subject matter, do **Part A**. If you do not wish to research this subject matter, do **Part B**.

Part A

Read the entire investigation on page 177 of the textbook.

Follow the instructions in "What to Do" closely. Use the Internet or your local library to search for information regarding this topic.

7. Answer questions 1 and 2 of "Analyze."

Check your answers on pages 98 and 99 of the Appendix.

Part B

Use the Internet or your local library to find information on the Spanish flu. Find out how and why the Spanish flu spread and what affect it had on societies throughout the world. When using the Internet, enter phrases like *Spanish flu*, *Spanish flu of 1968–1969*, and *avian flu* into any of the Internet's search engines.

8. Write a short report (1 page or so) about the Spanish flu.

Check your answer on page 99 of the Appendix.

Over the centuries there have been a number of pandemics and epidemics. For more information on pandemic and epidemic diseases, read "Pandemic and Epidemic Diseases" on pages 178 and 179 of the textbook. Study the time line in Figure 10.2 closely.

9. What is the difference between a pandemic disease and an epidemic disease?

10. Name the four pandemic and epidemic diseases that have occurred over the past seven centuries.

11. Briefly describe the following diseases.

    a. tuberculosis

    b. AIDS

12. Name five social conditions that contributed to the Bubonic Plague Pandemic of 1346–1350.

13. Define *quarantine*.

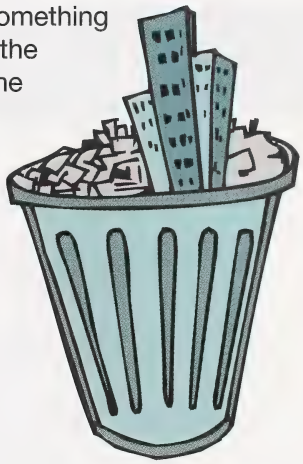
14. a. What percent of Aboriginal and Inuit children in residential schools in western Canada died of tuberculosis in the early 1900s?

    b. What impact did tuberculosis have on Aboriginal and Inuit populations in western Canada?

15. List three effects of AIDS on the population today.

CHECK Check your answers on pages 99 and 100 of the Appendix.

Public health and government involvement in health is something many people take for granted in many countries around the world. This was not always the situation and still is not the case in some countries.



Read "The Beginning of Public Health" on page 180 of the textbook to learn about the origins of public health.

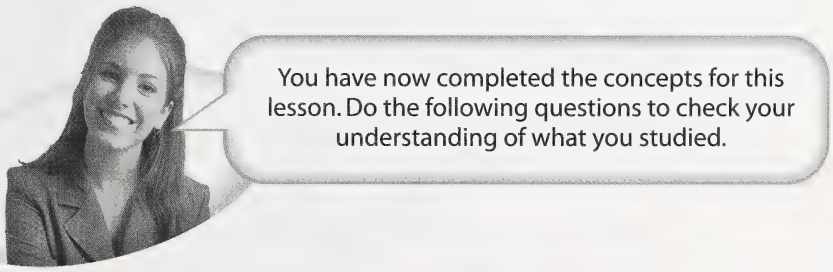
16. How did people come to realize that there was a connection between sanitation and disease?

17. What is public health?

18. What did England try doing in "The Year of the Great Stink"?

19. How do some countries still handle sewage today?

CHECK Check your answers on pages 100 and 101 of the Appendix.


You have now completed the concepts for this lesson. Do the following questions to check your understanding of what you studied.

20. Answer questions 1 and 4 of "Check Your Understanding" on page 180 of the textbook. **Note:** A partner is not necessary for question 4. You can write a short report in place of an oral presentation.

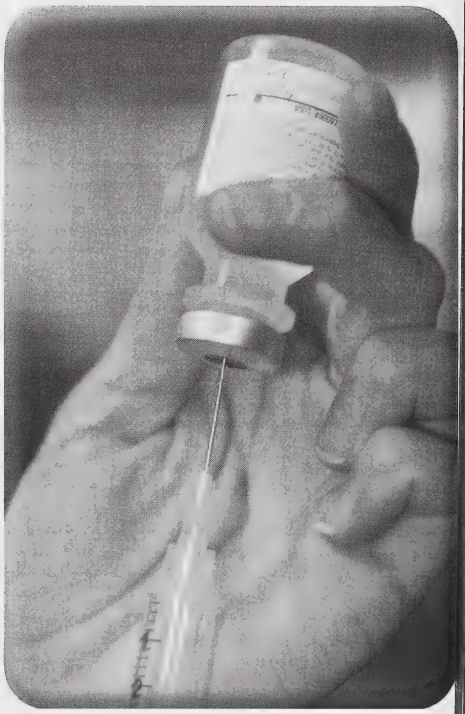
CHECK Check your answers on page 101 of the Appendix.

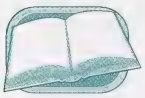
Go to ... Go to pages 5 and 6 of Assignment Booklet 3A and answer questions 1 to 3.

Lesson 2

Improving Human Health

Have you or someone you know received a vaccination recently? If you live in a rural area, has the water you drink been tested recently? Today, many people take health centres and public health systems for granted. Health authorities offer many public health programs and services, from providing flu shots to testing drinking water.





Turn to pages 181 to 183 of the textbook and read "Improving Human Health."

1. When was the first department of health established in Canada?

2. Name three jobs done by provincial health departments.

3. What name is given to the public health service in Alberta?

4. Name the six services provided by public health organizations.

5. What service do public health organizations perform with regard to beach water in lakes?

6. Which organization developed the standards and guidelines that list allowable levels of pollutants in the air you breathe?

7. Why are people told to avoid heavy physical exercise when pollution levels are high?

8. What services do public health organizations provide in terms of mass vaccinations?

9. Name the four points that the *Fight*BAC! educational campaign promotes regarding proper food handling.

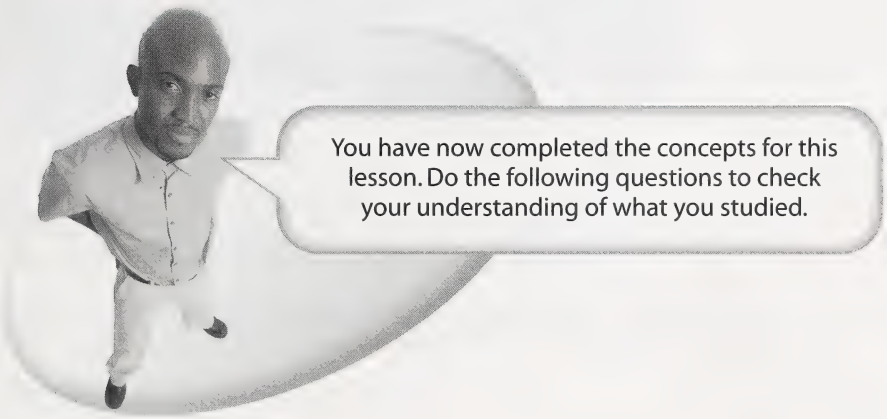
Check your answers on pages 101 and 102 of the Appendix.

Turn to page 183 of the textbook and re-read "The Choice Is Yours."

10. What does the heading, "The Choice Is Yours," mean in terms of disease prevention?

11. How can you help prevent the spread of disease?

Check your answers on page 102 of the Appendix.


You have now completed the concepts for this lesson. Do the following questions to check your understanding of what you studied.

12. Answer questions 1, 2, 3, and 5 of "Check Your Understanding" on page 183 of the textbook.

Check your answers on pages 102 and 103 of the Appendix.

Go to pages 6 and 7 of Assignment Booklet 3A and answer questions 4 to 7.

Lesson 3

Public Health and You

What does public health do for you as an individual? Do you remember the last time hamburger meat or vegetable produce were recalled? Did someone in your family happen to buy produce just before a recall? Public health organizations are always on the lookout for potential health problems.

In addition to providing programs and services regarding heath, public health organizations set up guidelines to help protect the public from various disease sources.

Turn to page 184 of the textbook and read the introductory paragraphs of "Public Health and You." Study Table 10.1 closely.

1. Name a communicable disease that has been eliminated from most countries.

2. Why do people in developed countries still need to follow public health guidelines even though a number of communicable diseases have been eliminated or reduced?

3. Name two diseases that have resurfaced after it was thought they were eliminated.

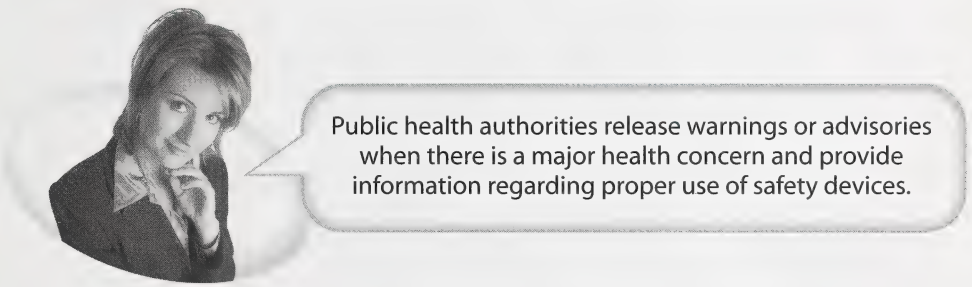
4. Name two new communicable diseases that have appeared in the last 30 years.

5. Population growth and overcrowding and travel are two factors that concern public health authorities.

   a. What concerns do public health authorities have with these two factors?

   b. What guidelines have public health authorities established concerning these two factors?

Check your answers on page 103 of the Appendix.


Public health authorities release warnings or advisories when there is a major health concern and provide information regarding proper use of safety devices.

Turn to page 185 of the textbook and read "Health Warnings" for more information regarding health warnings and advisories.

6. List four warnings or advisories public health authorities may release.

7. When is a boil-water advisory issued?

8. Why did public health officials encourage legislators to pass a law requiring all cyclists under the age of 18 to wear a helmet while cycling?

9. Describe a road safety warning that could affect you.

Check your answers on page 104 of the Appendix.

Do you recall the water quality problems that occurred in Walkerton, Ontario, in 2000 and in North Battleford, Saskatchewan, in 2001? Both of these problems occurred when public drinking water was contaminated. In the next investigation you will analyze the role public health has regarding public drinking water.

Investigation

10-B: Who Is Watching the Water?

Read the entire investigation on page 186 of the textbook.

Follow the instructions in "What to Do" carefully.

10. Answer question 1 of "What to Do." Refer to the information timeline in "Walkerton's Water Tragedy." **Note:** You do not need to discuss the questions in a group; simply answer the questions yourself.

11. Answer question 2 of "Analyze." You may do a written report in place of an oral presentation.

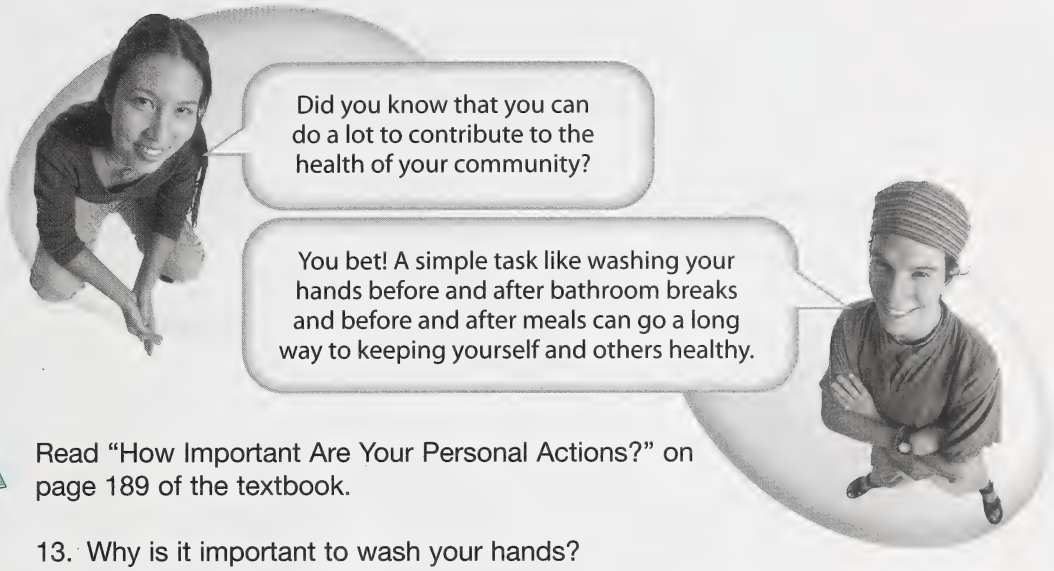
CHECK Check your answers on pages 104 and 105 of the Appendix.

Public health authorities not only help prevent disease, they also work actively to promote wellness. They provide programs to improve the quality of life for individuals through all stages of development, from the womb to the grave.

Read "From the Womb to the Grave" on page 187 of the textbook.

12. Explain why each of the four public health programs discussed in Figures 10.13 to 10.16 are important.

CHECK Check your answer on page 105 of the Appendix.


Did you know that you can do a lot to contribute to the health of your community?
You bet! A simple task like washing your hands before and after bathroom breaks and before and after meals can go a long way to keeping yourself and others healthy.

Read "How Important Are Your Personal Actions?" on page 189 of the textbook.

13. Why is it important to wash your hands?

14. How do choices that protect your personal health also help protect the health of others in your community?

CHECK Check your answers on page 105 of the Appendix.

In this lesson you analyzed public health and described how public health serves the community. If you have access to the Internet, you may wish to go to the following website to learn about various chemicals and public health:

http://toxtown.nlm.nih.gov

Some parts of this site tie into the information on pollution in Module 1. For more information on public health and drinking water, go to the link on drinking water in both the town and city sites.

15. Answer questions 1, 2, and 3 of "Check Your Understanding" on page 189 of the textbook.

CHECK Check your answers on page 106 of the Appendix.

Go to ... Go to pages 7 and 8 of Assignment Booklet 3A and answer questions 8 to 11.

Section 2 Review

In this section you identified widespread diseases and how they affect society. You then analyzed the importance of health programs and good personal hygiene. You described how public health guidelines help maintain the health of a community and how individuals maintain personal and public health.

The discussion in this section of how disease affects society and how public health authorities work to prevent the spread of disease should help you understand the need for public health authorities. You observed that you, as an individual, can help to reduce the spread of disease within your community by following certain personal actions. What are you doing to help reduce the spread of disease?

You have now completed the concepts for this section. To review what you covered, answer the following "Chapter 10 Review" questions on pages 190 and 191 of the textbook. If necessary, go back and read over parts of this section as you answer the questions.

1. Answer questions 3 and 4 of "Reviewing Key Terms."
2. Answer questions 5 and 6.b. of "Understanding Key Ideas."
3. Answer questions 10 and 11 of "Developing Skills."
4. Answer question 14 of "Problem Solving/Applying."
5. Answer question 15 of "Critical Thinking."

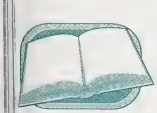
Check your answers on pages 106 to 108 of the Appendix.

Section 3

PROTECTING YOURSELF FROM DISEASE

Most people are in contact with a large number of other people on any given day. Students and teachers, for example, mix with others in the school. Just think of all the people you come in contact with at the grocery store or at the mall, especially West Edmonton Mall. Often, in these places many people are coughing and sneezing. Why is it that you don't get sick more often than you do? The answer lies in the lines of defence your body has to fight disease.

In this section you will identify ways your body protects itself from disease and infections. You will identify your body's physical defence mechanisms against infection. You will describe how your blood helps control pathogens and how your immune system protects you. You will then discover how antibiotics and vaccinations prevent or treat disease, and you will analyze the dangers of not using antibiotics properly.

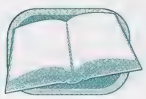


Turn to pages 192 and 193 of the textbook and read the introductory paragraphs of "Chapter 11: Protecting Yourself from Disease." Check out the points in "What You Will Learn," "Why It Is Important," and "Skills You Will Use" on page 193. These will give you a quick overview of what you will cover in this section.

Lesson 1

Defences Against Pathogens

physical defence: a first line of defence against disease involving structures that provide physical barriers to pathogens



What do you think of when asked how your body defends itself against disease? Do you think of the white blood cells in your body and your immune system? Did you know that skin, nose and sinuses, tears, eyelids, eyelashes, earwax, and hair are all part of your body's **physical defences** against disease?

Read the introduction to "Defences Against Pathogens" on page 194 of the textbook. Study Figure 11.1 closely.

1. What are the three lines of defence your body has against disease?

2. What are two ways in which your nose and sinuses defend against disease?

3. How do tonsils and adenoids defend against disease?

4. How do eyelids and tears protect your body against disease?

5. How do eyelashes and hair protect against disease?

6. How do parts of the ear protect you against disease?

7. How does skin protect you against disease?

8. How does the stomach protect you against disease?

Check your answers on page 108 of the Appendix.

Do you recall the last time you had a sliver or cut? Did the area turn red and swell a little? This redness and swelling is called an **inflammatory response**. It is the body's second line of defence against disease.

Turn to page 195 of the textbook and read the information in "The Inflammatory Response."

inflammatory response: a swelling and increasing redness of an area around an injury or infection

9. Describe an inflammatory response.

10. Describe three types of inflammatory responses.

11. Why are physical defences and inflammatory responses called general defences?

12. What is the third line of defence?

13. What are macrophages?

14. How do macrophages destroy pathogens?

CHECK Check your answers on pages 108 and 109 of the Appendix.

Find Out Activity

Comparing Bacterial Growth

Read the entire activity on page 196 of the textbook.

Carefully follow the instructions in "What to Do."

15. Answer questions 1, 2, and 3 of "What Did You Find Out?"

CHECK Check your answers on page 109 of the Appendix.

You have now completed the concepts for this lesson. Do the following question to review what you studied.

16. Answer question 4 of "Check Your Understanding" on page 196 of the textbook.

Check your answer on page 109 of the Appendix.

Go to ... Go to pages 1 and 2 of Assignment Booklet 3B and answer questions 1 to 5.

Lesson 2

Immunity

immunity: resistance to disease

Have you had the chicken pox or measles? Most people contract these diseases when they are young. If you haven't had the chicken pox or measles, maybe you were vaccinated for these diseases and, thus, haven't contracted them. Maybe you have a natural **immunity** to these diseases. Ask your parents, grandparents, or an older relative if they've had the chicken pox or measles. If they did, they most likely will never get them again. This is because their bodies have built up a resistance to the diseases. The same goes for those who received vaccinations for chicken pox and measles. Their bodies have built up a resistance to the diseases because of the vaccinations. This resistance to disease is called immunity.

Turn to page 197 of the textbook and read the introductory information of "Immunity."

1. What is immunity?

2. What are antigens?

3. What are antibodies?

4. How does having a disease once help you to resist the disease next time you come in contact with it?

5. How does an antibody combine with a particular antigen?

6. Refer to the diagram at the bottom of page 197 of the textbook. Can Antibody Type B attach itself to the antigen marker of the invading pathogen shown? Why?

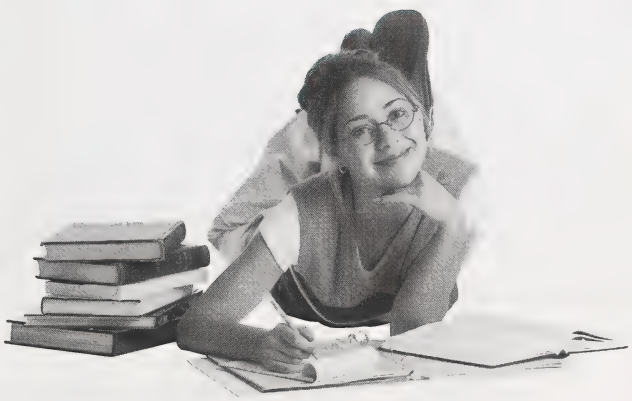
7. Would the antigen marker for chicken pox be the same as the antigen marker for measles?

8. Read "Did You Know?" in the middle of page 197 of the textbook.

   a. What are anti-rejection drugs?

   b. What is a problem associated with anti-rejection drugs?

CHECK Check your answers on page 110 of the Appendix.



There are a number of steps that biologists have identified in how the immune system reacts when a particular pathogen invades the body. To learn about these steps, read "Immune System on Alert" on page 198 of the textbook. Study Figure 11.5 carefully as you read the information in steps 1 to 5.

9. What happens when a macrophage first encounters a bacterium?

10. a. What is the purpose of helper T cells?

    b. What makes it easier for helper T cells to identify the antigens?

11. What is the purpose of B cells?

12. What do the memory cells do?

Check your answers on page 110 of the Appendix.

If you have access to a compound microscope and a prepared slide of human blood, you may wish to complete "Find Out Activity: Detecting Infection" on page 198 of the textbook.

Immunity can be inherited or acquired. There are several types of acquired immunity. To learn more, read "Types of Immunity" on page 199 of the textbook.

13. Describe the type of immunity you are born with.

14. What type of immunity is built up from birth?

15. What are two types of acquired immunity?

16. How do you get active acquired immunity?

17. How do you get passive acquired immunity?

Check your answers on page 111 of the Appendix.

For more information on immunity, insert the *Science.Connect 2 Student Multimedia* CD into your computer. Open the applet "Immunity" from the main menu. Starting with Part 1: Have You Ever Had a Cold?, follow the instructions throughout the applet and answer the following questions as you go.

18. What are viruses made of?

19. What is one way scientists can distinguish the AIDS virus from the polio virus?

20. Where do viruses reproduce?

21. List the five stages in the life cycle of a virus.

22. What do you think happens to the host cell at the end of the virus's life cycle?

23. What happens during the infection and takeover stages in the life cycle of a virus?

24. Why are macrophages called the soldiers of the immune system?

25. How does the AIDS virus cause death?

Check your answers on page 111 of the Appendix.

Antigens and antibodies are important considerations when people are given blood transfusions. This is why the type of blood given to a person must be checked carefully. The next activity investigates human blood types.

Investigation

11-A: Blood Transfusions

Read the entire investigation on page 200 of the textbook.

If you have access to a supervised laboratory, do **Part A**. If you do not have access to a supervised laboratory, do **Part B**.

Part A

Follow the procedure to carry out this investigation. **Pay special attention to the safety precautions mentioned.**

26. Complete a table like the following.

Simulated Blood Type	Reaction with Simulated A Antibodies	Reaction with Simulated B Antibodies
Type A		
Type B		
Type AB		
Type O		

27. Answer the following on page 200 of the textbook.

    a. question 1 of "Analyze"

    b. questions 2 and 3 of "Conclude and Apply"

Check your answers on page 112 of the Appendix.

Part B

Use the following table, which was completed by a student who performed this investigation, to answer question 27 in Part A.

Simulated Blood Type	Reaction with Simulated A Antibodies	Reaction with Simulated B Antibodies
Type A	clumps formed	no clumps
Type B	no clumps	clumps formed
Type AB	clumps formed	clumps formed
Type O	no clumps	no clumps

You have now completed the concepts for this lesson.
Do the following questions to check what you studied.

28. Answer questions 1 and 3 of "Check Your Understanding" on page 201 of the textbook.

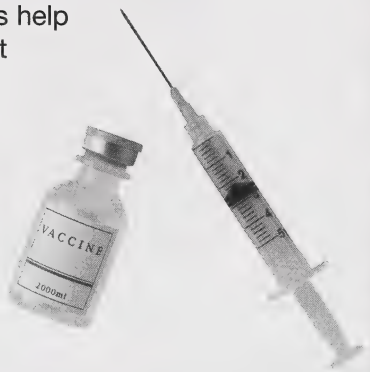
CHECK Check your answers on page 113 of the Appendix.

Go to ... Go to pages 2 to 4 of Assignment Booklet 3B and answer questions 6 to 14.

Lesson 3

Immunization

Earlier in this module you studied how vaccinations help people resist particular diseases. Are you confident in how vaccines work? Have you received any immunizations recently? Immunizations help your immune system build up resistance to diseases.



Turn to page 201 of the textbook and read the introductory information of "Immunization." Study Table 11.1 closely.

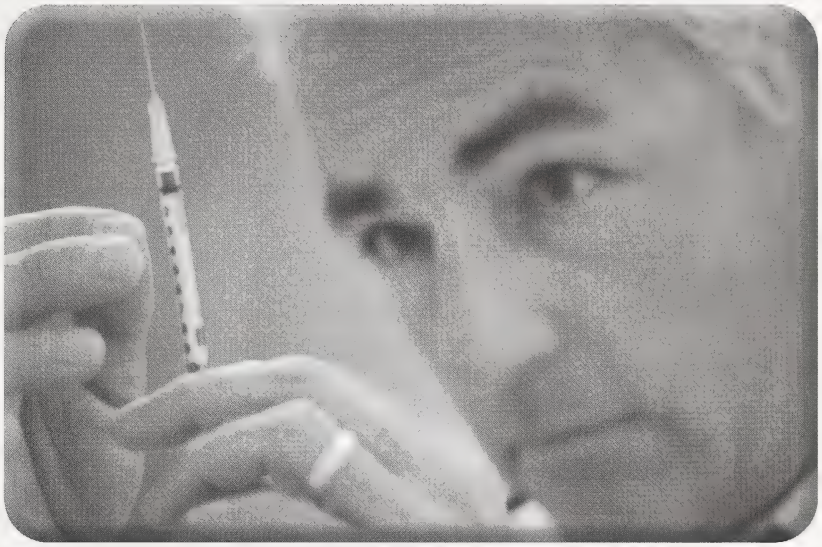
1. What makes up a vaccine?
2. What happens once you get a vaccination?
3. Why don't you get the disease from the vaccination?
4. How are the injections for tetanus and diphtheria different than other vaccinations?
5. Name the diseases that most Canadians are immunized against.
6. Where did you get your antibodies from when you were born?
7. Give one benefit of breast-feeding.

CHECK

Check your answers on page 113 of the Appendix.

If you have access to the Internet, do "Internet Connect" on page 201 of the textbook. This activity will provide information on the first-ever vaccination for smallpox.

Immunizations can prevent people from getting certain diseases. Yet, some people cannot get immunization shots, and others do not want to get immunization shots.



Turn to page 202 of the textbook and read "Why Get Immunization Shots?"

8. Why do some people not get immunizations?

9. Why should people get immunizations if they can take them?

10. What has happened in some countries where immunization programs have been stopped?

Check your answers on page 114 of the Appendix.

Allergies are an overreaction of the immune system to various substances. These substances, called allergens, may be non-food (e.g., dust, pollens, smoke, and pesticides) or may be food (e.g., wheat, peanut butter, eggs, milk, and chocolate). The reaction to allergens can be mild, such as a runny nose or itchy, watery eyes; or it can be severe, such as difficulty breathing or even death.

Read "Allergies" at the bottom of page 202 of the textbook.

11. How can an immune response cause an allergy?

12. Describe the tests used to identify allergens.

13. What is immunotherapy?

Check your answers on page 114 of the Appendix.

Studies indicate that allergies in adult Canadians is increasing. In fact, it appears that women seem to be more susceptible to this increase than men. Just how widespread are allergies? How many people do you know suffer from allergies? The next activity will help you answer these questions.

Find Out Activity

Allergies

Read the entire activity on page 203 of the textbook.

If you are doing this course in a classroom setting, do **Part A**. If you are doing this course in a non-classroom setting, do **Part B**.

Part A

Complete this activity by carefully following steps 1 to 3 of "What to Do."

14. Answer questions 1, 2, and 3 of "What Did You Find Out?"

Check your answers on page 114 and 115 of the Appendix.

Part B

Use the Internet or your local library to research the following allergens to complete steps 2 and 3 of "What to Do."

- dust mites
- nuts
- insect bites
- fur or feathers
- pollen

15. Answer questions 2 and 3 of "What Did You Find Out?"

Check your answers on page 115 of the Appendix.

You have now completed the concepts for this lesson. Do the following questions to review what you covered.

16. Answer questions 1 and 3 of "Check Your Understanding" on page 203 of the textbook.

Check your answers on page 115 of the Appendix.

Go to pages 4 and 5 of Assignment Booklet 3B and answer questions 15 to 19.

Lesson 4

Treating Infectious Diseases

When you get a sore throat, do you get an antibiotic to fight it or do you stay at home, get plenty of rest, and drink fluids? Overuse of antibiotics can result in the development of bacteria that are resistant to antibiotics. New antibiotics can be developed to combat the new strain; but these strains can mutate again, giving rise to new bacteria that are resistant to the new antibiotics. It is now believed that the treatment of bacterial infections with drugs must be balanced with the body's ability to fight infection on its own.

Read the introduction to "Treating Infectious Diseases" on page 204 of the textbook to learn about penicillin and antibiotics in general.

1. Why is there no vaccine for the common cold?
2. What are over-the-counter drugs?
3. What type of pathogens can an antibiotic fight?
4. Name three substances scientists today use to develop antibiotics.
5. How did Sir Alexander Fleming first discover that bacteria could be destroyed by mould?

CHECK

Check your answers on page 116 of the Appendix.

Antibiotics are a valuable tool for use against bacterial infections. However, antibiotics can be overused, resulting in a number of problems. Read "Problems with Antibiotics" on page 205 of the textbook for more information on these problems.

6. For what types of illnesses are people demanding antibiotics?

7. State three problems associated with the overuse of antibiotics.

8. Describe how antibiotic-resistant bacteria develop.

9. Which substance is a natural antibiotic?

CHECK Check your answers on page 116 of the Appendix.

Insert the *Science.Connect 2 Student Multimedia* CD into your computer, and launch the "Bacteria" applet. Starting with Part 7: Antibiotics, answer the following questions as you proceed through this applet.

10. Describe how scientists test new antibiotics.

11. a. Which antibiotic was most effective against the strep bacteria?

    b. What did the control indicate?

12. Which antibiotic was most effective against the staph bacteria?

13. Which antibiotic was most effective against the hemophilus bacteria?

14. Why might a doctor prescribe an antibiotic that is not the most effective antibiotic against a particular bacteria to a patient?

15. What are three ways in which bacteria are beneficial for humans?

16. What are two ways in which bacteria are harmful for humans?

CHECK Check your answers on pages 116 and 117 of the Appendix.

Read the information in "Use Antibiotics Safely" and in "Did You Know?" at the top of page 206 of the textbook.

17. To take antibiotics safely, what are three things you should consider?

18. What information does the label on a bottle of medicine provide?

19. How might patients have taken their medicine that resulted in them going to the hospital?

Check your answers on page 117 of the Appendix.

Millions of people use over-the-counter drugs to treat headaches, fevers, sore throats, back aches, and so on. In most cases, over-the-counter drugs are safe. However, some people may have allergic reactions to certain medications in an over-the-counter drug or may have other side effects.

Read the information given in "Handling Over-the-Counter Drugs" and "Choosing Over-the-Counter Drugs" on page 206 of the textbook.

20. Why should you **not** try treating symptoms for a problem you have had before with an over-the-counter drug without first seeking the advice of a doctor or pharmacist?

21. What information should you look for when purchasing over-the-counter drugs?

22. Name one side effect that may have serious consequences while operating a motor vehicle.

Check your answers on page 117 of the Appendix.

Investigation

11-B: Over-the-Counter Drugs

Read the entire investigation on page 207 of the textbook.

Follow the instructions in "What to Do" closely. Use the following list of ingredients for nasal decongestants and for cough suppressants to help you complete the table in question 23.

Nasal Decongestants

- ephedrine
- ephedrine HCl
- ephedrine sulfate
- dexbrompheniramine maleate
- glyceryl guaiacolate
- chlorpheniramine maleate
- pseudoephedrine HCl
- pseudoephedrine sulfate
- pyrilamine maleate

Cough Suppressants

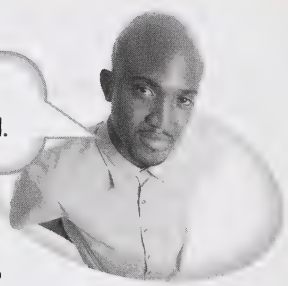
- codeine
- codeine phosphate
- diphenhydramine HCl
- dextromethorphan HBr
- guaifenesin
- hydrocodone bitartrate

23. Complete the following table for the three medications you chose.

Product	Medicinal Ingredients	Precautions and Side Effects	Advertising Claims	Do Ingredients Correspond with Advertising Claim?

24. Answer questions 1, 2, and 3 of "Analyze."

CHECK Check your answers on pages 118 and 119 of the Appendix.



You have now completed the concepts for this lesson.
Do the following questions to review what you studied.

25. Answer question 1 of "Check Your Understanding" on page 207 of the textbook.

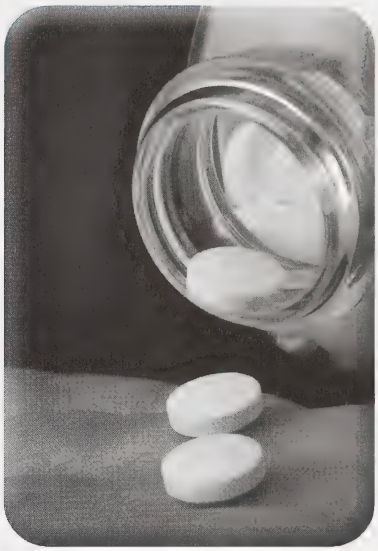
26. List, in point form, what you need to look for when choosing an over-the-counter medication.

CHECK Check your answers on page 119 of the Appendix.

Go to ... Go to page 5 of Assignment Booklet 3B and answer questions 20 to 22.

Section 3 Review

In this section you identified ways your body protects itself from disease and infection. You also identified your body's physical defence mechanisms against infection. You described how your blood helps control pathogens and how your immune system protects you. You then described how antibiotics and vaccinations treat or prevent disease, and you analyzed the dangers of not using antibiotics properly.



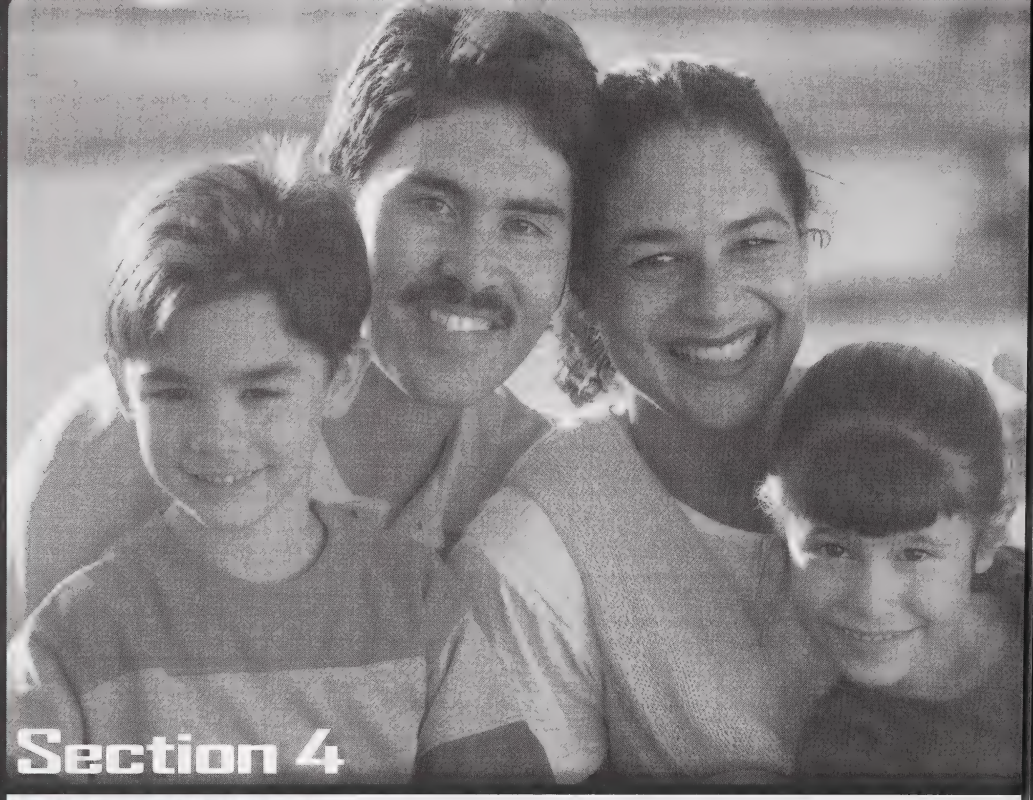
When you buy over-the-counter drugs, do you check which symptoms the product is intended to treat? Do you pay attention to the warnings and side effects? After completing this section, you should now have a new respect for these readily available drugs.

You have now completed the concepts for this section. To review what you covered, answer the following "Chapter 11 Review" questions on pages 208 and 209 of the textbook. If necessary, go back and read over parts of this section as you answer the questions.

1. Answer question 1 of "Reviewing Key Terms."
2. Answer questions 4 and 6 of "Understanding Key Ideas."
3. Answer question 9 of "Developing Skills."
4. Answer question 11 of "Problem Solving/Applying."
5. Answer question 14 of "Critical Thinking."

CHECK

Check your answers on pages 119 to 121 of the Appendix.



Section 4

GENETICS AND HEALTH

Why do doctors always ask about any family history of heart disease or cancer? Genetics is closely related to health. Many traits, like double-jointed thumbs, and disorders, like heart disease, are passed on from generation to generation. In fact, you inherited many traits from your parents who, in turn, inherited many traits from their parents. In essence, you inherited traits from your grandparents. Which traits do you think came from your grandparents?

In this section you will describe how physical characteristics are inherited in humans and how chromosomes determine the sex of a child. You will also determine how genetic information is organized in the cells of your body. You will then investigate human diseases that result from changes to genetic make-up and identify social issues related to genetic research.

Turn to pages 210 and 211 of the textbook and read the introductory paragraphs of "Chapter 12: Genetics and Health." Check out the points outlined in "What You Will Learn," "Why It Is Important," and "Skills You Will Use" on page 211. These will give you a quick overview of what you will cover in this section.

Lesson 1

Structure of DNA

Usually, when people see a baby for the first time, you often hear something like, "She looks like her father," or "She has her mother's nose and her father's eyes." How did these characteristics get passed on to the baby? The answer lies in the understanding of a branch of science called genetics. The unique code for the genetic make-up of a person is contained in DNA in the nucleus of each cell that makes up the body.

The following activity will help you to determine which characteristics are most common among people.

Starting Point
Activity

Which Characteristics Are Most Common?

Read the entire activity on page 211 of the textbook.

If you are completing this course in a classroom setting, do **Part A**. If you are completing this course on your own, do **Part B**.

Part A

Follow the instructions in "What to Do." Use the following table to record and analyze your findings. **Note:** For the second digit finger, determine whether it is shorter or longer than the ring finger.

Characteristic	Option 1		Option 2	
dimples	dimples present		no dimples	
eye colour	brown/green		blue/grey	
earlobe	detached		attached	
hair colour	brown/black		blond/red	
second digit finger	short		long	
skin pigment	freckles		no freckles	
thumb	bends back		does not bend back	
tongue	can roll		cannot roll	

1. Answer questions 2, 3 and 4 of "What Did You Discover?"

Check your answers on page 121 of the Appendix.

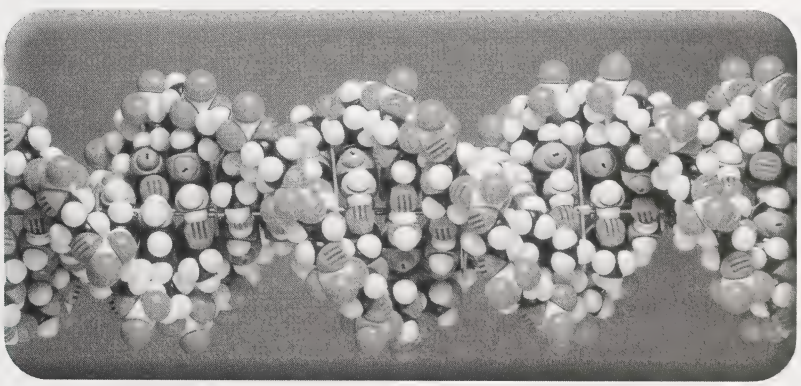
Part B

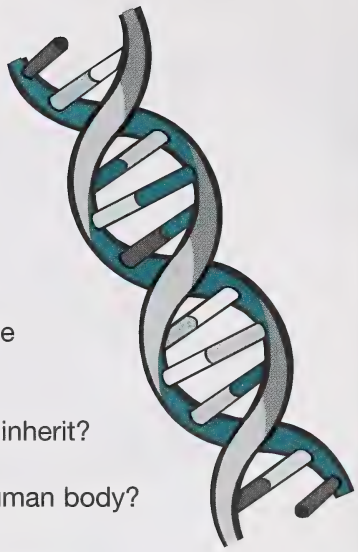
The following table provides data that was collected by a class of 32 students. Check which option you have for each characteristic. Use this table to answer question 1 in Part A.

Characteristic	Option 1		Option 2	
dimples	dimples present	18	no dimples	14
eye colour	brown/green	19	blue/grey	13
earlobe	detached	24	attached	8
hair colour	brown/black	23	blond/red	9
second digit finger	short	25	long	7
skin pigment	freckles	3	no freckles	29
thumb	bends back	2	does not bend back	30
tongue	can roll	28	cannot roll	4

In the preceding activity you observed a number of characteristics and found which were more common in most people and which corresponded to you. How do you get each of these characteristics?

Turn to page 212 of the textbook and read the introductory information of "Structure of DNA." Then continue by reading "The Structure of DNA" on pages 212 and 213. You will discover how you obtained the characteristics you have.





2. What is genetics?

3. Where is the unique code for your genetic make-up stored?

4. Describe how the your genetic information is organized.

5. Using graphic D in Figure 12.1, describe how the structure of DNA is organized.

6. How do the base pairs determine the traits you inherit?

7. a. How many chromosomes are there in the human body?

   b. How many chromosomes come from each parent?

8. a. How do scientists organize the chromosomes for study?

   b. What chromosome combination determines the sex of a baby?

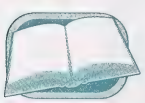
   c. What is the sex chromosome combination for human females and for human males?

9. How do scientists determine what the chromosomes they use in the chromosome map should look like?

10. What percent of your DNA makes you different from another person?

Check your answers on pages 121 and 122 of the Appendix.

If you wish to obtain more information on the structure of DNA, do "Internet Connect" on page 213 of the textbook.



11. Answer questions 2, 3, and 4 of "Check Your Understanding" on page 215 of the textbook.

Check your answers on page 122 of the Appendix.

Go to page 6 of Assignment Booklet 3B and answer questions 1 to 5.

Lesson 2

Inheritance and Genetics

Half of the chromosomes for each child in the photograph come from the mother and half come from the father. Do the children look identical? Do you look identical to your brothers and sisters, if you have any?

Not all traits are passed from one generation to the next. The passing of traits from parents to offspring was first studied by Gregor Mendel in the mid 1800s. Mendel crossed tall and short pea plants to see how height would be affected in the offspring.

Turn to page 216 of the textbook and read the introductory paragraphs of "Inheritance and Genetics." You will find more information on Mendel's work with heredity of crossing pea plants.

1. What did Mendel discover when he crossed the following pea plants?

   a. tall parent pea plants with tall parent pea plants

   b. short parent pea plants with short parent pea plants

c. tall parent pea plants with short parent pea plants

d. tall hybrid pea plants with tall hybrid pea plants

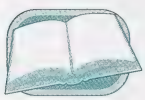
2. Why did Mendel call the tallness trait dominant and the shortness trait recessive?

3. What conclusion did Mendel come to when he observed that tall hybrid plants produced some tall plants and some short plants?

Check your answers on page 123 of the Appendix.

Geneticists—people who study the traits of various plants and animals—have found that many traits are controlled by only one pair of genes. For those traits controlled by only one pair of genes, geneticists use two letters to represent a **genotype**, a specific combination of genes.

genotype: a combination of genes



Read "Recording Inherited Traits" on page 217 of the textbook for more information on how geneticists represent genotypes.

4. Describe how geneticists use letters to represent a genotype.

5. Why is only one gene for each trait passed on to the offspring from each parent?

6. What is a Punnett square?

7. How does the Punnett square show that only one short pea plant will result if two tall hybrid pea plants are crossed?

8. Would any of the offspring in Punnett square C be short? Explain.

Check your answers on page 123 of the Appendix.

Example: Using Punnett Squares

Eye colour is a genotype in animals that can be predicted using a Punnett square. The symbol B is used for the dominant gene for eye colour (brown) and the symbol b is used for the recessive gene for eye colour (blue).

a. Write the symbols for the three possible genotypes.

b. Use a Punnett square to predict the probability of offspring inheriting brown eyes if one parent has both dominant genes for eye colour and the other parent has both recessive genes for eye colour.

c. Use a Punnett square to predict the probability of offspring inheriting brown eyes if one parent has one dominant gene and one recessive gene and the other parent has both recessive genes for eye colour.

Solution

a. The three possible genotypes for eye colour are BB, Bb, and bb.

b. **BB × bb**

	B	**B**
b	Bb	Bb
b	Bb	Bb

All four genotypes have the dominant gene for eye colour. Therefore, any offspring will have brown eyes.

c. **Bb × bb**

	B	**b**
b	Bb	bb
b	Bb	bb

Because the Punnett square has two genotypes with the dominant gene for eye colour and two genotypes with only the recessive gene for eye colour, there is a 50% chance the offspring will have brown eyes.

For humans, other genes may be involved. This results in many variations of eye colour (blue, green, hazel, brown, etc.).

For more information on inheritance and using a Punnett square, insert the *Science.Connect 2 Student Multimedia* CD into your computer. Launch the "Genetics" applet, and complete Parts 1 to 5.

9. In Part 5 of the "Genetics" applet, what are the chances of an offspring having an attached earlobe?

10. Answer "Reading Check" at the bottom of page 217 of the textbook.

11. Complete "Try This!" on page 217 of the textbook.

Check your answers on pages 123 and 124 of the Appendix.

pedigree: a diagram showing the history of a trait from generation to generation

A **pedigree** is a diagram that shows the history of a trait from generation to generation. A pedigree can be used as a tool to trace a certain trait in a family. Pedigrees are used by plant and animal breeders to increase the chances of breeding desirable traits.

Find Out
Activity

Interpreting a Pedigree

Insert the *Science.Connect 2 Student Multimedia* CD into your computer, and launch the "Genetics" applet. Complete Parts 6 and 7, following the instructions carefully. Use this information to answer the questions that follow.

12. Which child has the specific trait found in the father?

13. From whom did the two sons get the genes for the lack of the specific trait?

14. How do you know from the pedigree that the mother has one dominant gene and one recessive gene for earlobe attachment?

15. If these parents had a fourth child would you say that its genotype for earlobe attachment would be ee?

CHECK

Check your answers on page 124 of the Appendix.

If you wish to learn more about pedigrees with dog or horse breeding, visit a dog or racehorse breeder in your area.

16. Answer questions 1, 2, and 3 of "Check Your Unde of the textbook.

CHECK

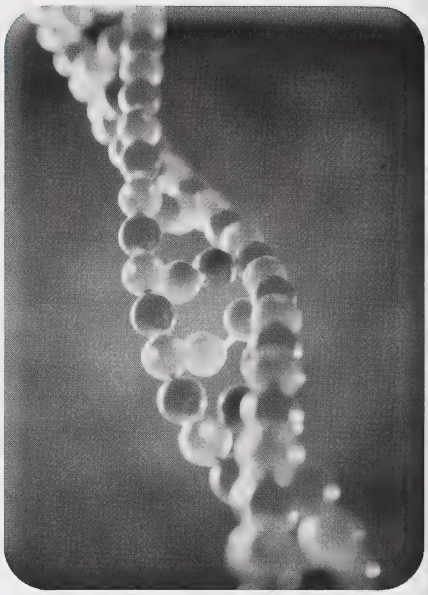
Check your answers on page 124 of the Appendix.

Go to ...

Go to page 7 of Assignment Booklet 3B and answer questions 6 to 9.

Lesson 3

Genetic Changes



Genetic mutations are changes in genetic information because of an abnormal gene. Genetic mutations occur when a mistake is made when chromosomes are copied during reproduction. Genetic mutations can be inherited or acquired during a person's lifetime.

Turn to page 220 of the textbook and read the introduction to "Genetic Changes" and the information in "Inherited Genetic Disorders."

1. What is a mutation?
2. How is gene **a**, which causes sickle-cell anemia, different from gene **A**?
3. What is a mutagen?
4. Name four examples of environmental factors that may cause mutations.
5. Do questions a., b., and c. of "Try This!" on page 220 of the textbook.
6. An offspring is a carrier if they have one abnormal gene but is not affected by it. Look at the resulting offspring in your answers to question 5. How many of the offspring are either carriers of sickle-cell anemia or have the disease in each situation?
7. What are the symptoms of sickle-cell anemia?
8. When might an inherited mutation be beneficial?

CHECK

Check your answers on pages 125 and 126 of the Appendix.

You may already know that radiation from nuclear bombs or from nuclear power plants can cause different types of cancer. A cancer cell is one in which the DNA in a normal cell has been altered.

At the beginning of this lesson you read about a number mutagens that may cause health problems. Now, turn to page 222 of the textbook and read "Genetic Disorders Caused by Mutagens."

9. What are two types of radiation that can cause mutations?

10. How can radiation be beneficial?

11. What stage of human life is most at risk to exposure to mutagens?

12. Name three mutagens that are especially harmful to human embryos. Give two effects of each mutagen.

CHECK Check your answers on page 126 of the Appendix.

In this lesson you have seen that genetics and environment affect the growth and health of organisms. In the next activity you will see how both genetics and environment play a role in the growth of corn seeds.

Investigation

12-C: Are Your Genes or Environment More Important?

Read the entire investigation on page 221 of the textbook.

If you are working in a classroom setting, do **Part A**. If you are working on your own, do **Part B**.

Part A

Obtain the required materials, and follow the instructions carefully to set up and carry out the investigation. Your teacher will provide you with genetic corn seeds. **Pay special attention to the safety precautions mentioned.**

13. Complete two tables similar to the following. Table 1 is for your seeds during the days of initial germination. Table 2 is for the three days of growth in good lighting conditions

TABLE 1

Lighting	Green Seed Totals	Albino Seed Totals	Green Seed Class Totals	Green Seed Class (%)	Albino Seed Class Totals	Albino Seed Class (%)
dark						
light						

TABLE 2

Lighting	Green Seed Totals	Albino Seed Totals	Green Seed Class Totals	Green Seed Class (%)	Albino Seed Class Totals	Albino Seed Class (%)
dark						
light						

14. Answer questions 2, 3, and 4 of "Conclude and Apply."

Check your answers on pages 126 and 127 of the Appendix.

Part B

A class of Science 24 students completed this investigation. The following tables show the data obtained by one student and by the class. Use this information to answer question 14 in Part A.

TABLE 1

Lighting	Green Seed Totals	Albino Seed Totals	Green Seed Class Totals	Green Seed Class (%)	Albino Seed Class Totals	Albino Seed Class (%)
dark	7	3	141	71	57	29
light	8	2	157	79	38	19

TABLE 2

Lighting	Green Seed Totals	Albino Seed Totals	Green Seed Class Totals	Green Seed Class (%)	Albino Seed Class Totals	Albino Seed Class (%)
dark	7	0	156	70	0	0
light	7	0	152	76	0	0

15. After doing Investigation 12-C, what can you conclude about the importance of heredity and environment factors for survival of plants?

Check your answer on page 127 of the Appendix.

You have now completed the concepts for this lesson. Do the following questions to check your understanding of what was covered.

16. Answer questions 1 and 3 of "Check Your Understanding" on page 222 of the textbook.

Check your answers on page 127 of the Appendix.

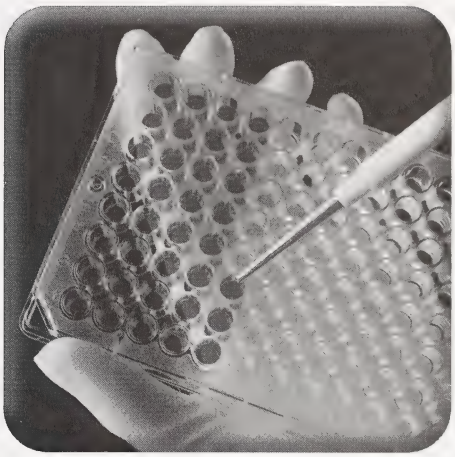
Go to pages 8 and 9 of Assignment Booklet 3B and answer questions 10 to 13.

Lesson 4

Issues in Genetic Research

Genetic research is a rapidly expanding field that has become a controversial social issue in recent years. Areas of research involving cloning, genetic engineering, and stem cells are issues that often appear in the news. In 2004 scientists in Japan fertilized an egg cell from a mouse using the genetic material from another mouse's egg cell. Mice born this way were all females, and the resulting embryo grew normally and produced normal offspring through normal sexual reproduction. The potential of producing one-parent human embryos is another issue that could be very controversial.

Not all issues in genetic research are controversial. Read the introductory information of "Issues in Genetic Research" on page 223 of the textbook. Study Table 12.2 closely.



1. What is a human genome?

2. What is genetic engineering?

3. How was genetic engineering used to make goats that produce milk with silk fibres?

4. How might genetic research be used with regard to diseases, such as cystic fibrosis or breast cancer?

5. What is amniocentesis?

6. Describe the three benefits of genetic research listed in Table 12.2.

CHECK

Check your answers on pages 127 and 128 of the Appendix.

All the various ways of using genetic research described on page 223 of the textbook seem to indicate that there is great potential for curing many human health conditions. However, there are many ethical issues that arise from this type of research.

Think about your answers to questions 1 to 6. What type of research do you think can give rise to ethical issues?

Turn to page 225 of the textbook and read "Concerns About Genetic Research." You will examine ethical issues that arise from genetic research.

7. What is an ethical question about?

8. How might an insurance company use information about the genetic make-up of a person to its advantage?

9. Would you want to know if you have a higher-than-normal chance of getting a serious disease for which there is no cure?

10. What would you see as a benefit of genetic research regarding serious diseases caused by abnormal genes?

Check your answers on page 128 of the Appendix.

Cloning is one of the new technologies that has ethical issues. A clone is an exact biological copy of an organism. In 1996 Dolly the sheep, a clone, was created using DNA from an adult ewe and inserting it into an unfertilized egg from a second sheep. The egg began dividing and was implanted into the uterus of a third sheep. This resulted in the birth of Dolly after a normal pregnancy.

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Dolly and Her Three Lambs

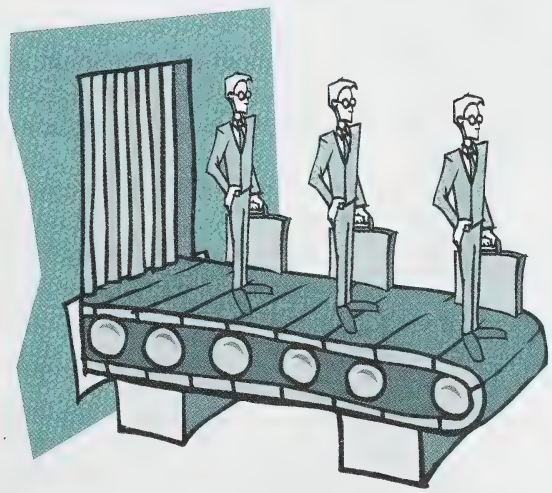
Dolly was put to sleep in 2003 after she developed a progressive lung disease. Reports are that Dolly was aging prematurely, developing arthritis. Scientists are assessing whether Dolly's problems were linked to the cloning techniques.

The cloning of Dolly the sheep has given rise to ideas of possibly cloning humans. Some have said that human body parts can be cloned to use for organ transplants. Others have said that humans could be cloned and used for body parts. All of these issues have very ethical concerns.

Investigation

12-D: To Clone or Not to Clone?

Read the entire investigation on page 224 of the textbook.



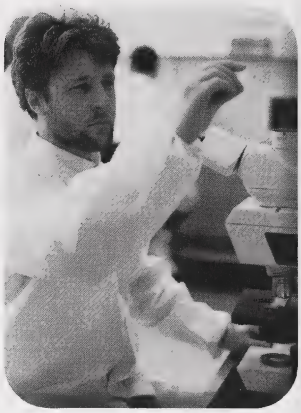
For this investigation, use the Internet or your local library to research cloning. Read articles about whether or not humans should be cloned. Use the information you obtain to help you form an opinion about whether or not the hypothetical scientist mentioned in "Think About It" should be cloned.

11. Complete steps 1 to 4 of "What to Do" on page 224.

12. Complete questions 3 and 4 of "Extend Your Skills."

CHECK Check your answers on pages 128 and 129 of the Appendix.

Stem-cell harvesting and their use in research is another area of controversy. Scientists think stem cells may be used to treat a variety of diseases. However, presently, stem cells are harvested from human embryos. This leads to the controversial issue of destroying human embryos in order to obtain stem cells. Embryonic stem cells can develop into any type of cell (blood cells, skin cells, muscle cells, etc.) there is in the human body.



To learn more about stem cells and stem-cell research, enter the words *stem cell research* into any of the Internet's search engines. You may also check out references at your local library.

13. Name some diseases scientists believe can be cured with stem cells.

14. Why are legislators battling over whether or not to allow stem-cell research?

Check your answers on page 129 of the Appendix.

You have now completed the concepts for this lesson. Do the following questions to check your understanding of what you studied.

15. Answer textbook questions 1 and 2 of "Check Your Understanding "on page 225 of the textbook. **Note:** It is not necessary to work with a partner to answer question 2.

Check your answers on pages 129 and 130 of the Appendix.

Go to pages 9 and 10 of Assignment Booklet 3B and answer questions 14 to 18.

Section 4 Review

In this section you described how humans inherit certain physical characteristics and how chromosomes determine the sex of a child. You determined how genetic information is organized in the cells of your body and investigated human diseases that result from changes to genetic make-up. You then identified social issues related to genetic research.

Everyone inherits traits from their ancestors. Do you recognize the traits you inherited from your parents? from your grandparents?

You have now completed the concepts for this section. To review what you covered, answer the following "Chapter 12 Review" questions on pages 226 and 227 of the textbook. If necessary, go back and read over parts of this section as you answer the questions.

1. Answer question 1 of "Reviewing Key Terms."
2. Answer questions 3, 4 and 7 of "Understanding Key Ideas."
3. Answer question 8 of "Developing Skills."
4. Answer questions 11 and 12 of "Problem Solving/Applying."
5. Answer question 14 of "Critical Thinking."

Check your answers on pages 130 to 134 of the Appendix.

Module Summary

In this module you studied the causes and treatments of disease, how society tries to protect you from disease, how you can protect yourself from disease, and how the genes you inherited affect what diseases may be at risk to you.

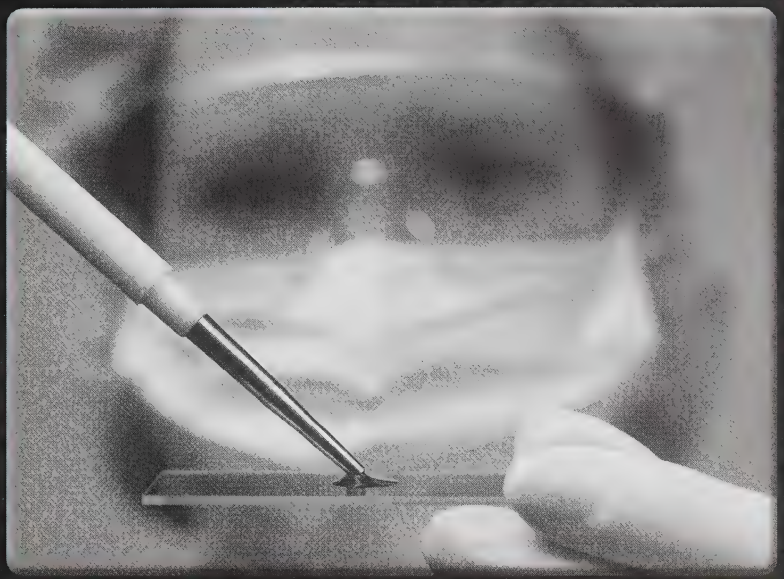
In Section 1 you identified causes of human disease and described how diseases spread. You studied communicable and non-communicable diseases and investigated techniques used to prevent food contamination. You then assessed the impact of techniques used to kill germs.

In Section 2 you explored widespread diseases and how they affect society. You analyzed the impact of contaminated water and learned about the importance of public health care programs and good personal hygiene. You later assessed the role of individuals in maintaining both personal and public health.

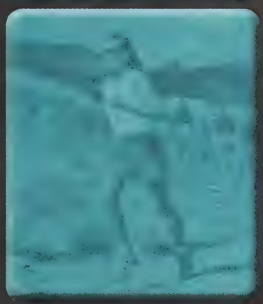
In Section 3 you identified your body's physical defences against infection and learned how your blood helps control pathogens. You discovered how your immune system protects you and how antibiotics and vaccines are used to treat and prevent disease. You identified some dangers of using antibiotics improperly and analyzed the use of over-the-counter drugs.

In Section 4 you determined how physical characteristics are inherited and how to illustrate and interpret hereditary characteristics. You described how genetic information is organized in the cells in your body and learned about human diseases that result from changes to genetic make-up. You then identified points of view concerning ethical and social issues related to genetic research.

Throughout this module you performed a number of simulated activities relating to disease identification and control. You found that the provision of health care and public health guidelines for disease prevention and control is not enough. You discovered that, as an individual, you must do your part in preventing the spread of infectious diseases. Do you do your part by maintaining good personal hygiene, following public health guidelines, getting the recommended vaccinations, and using antibiotics and other medications only when necessary?



MODULE 3 ■ DISEASE DEFENCE AND HUMAN HEALTH ■ MODULE

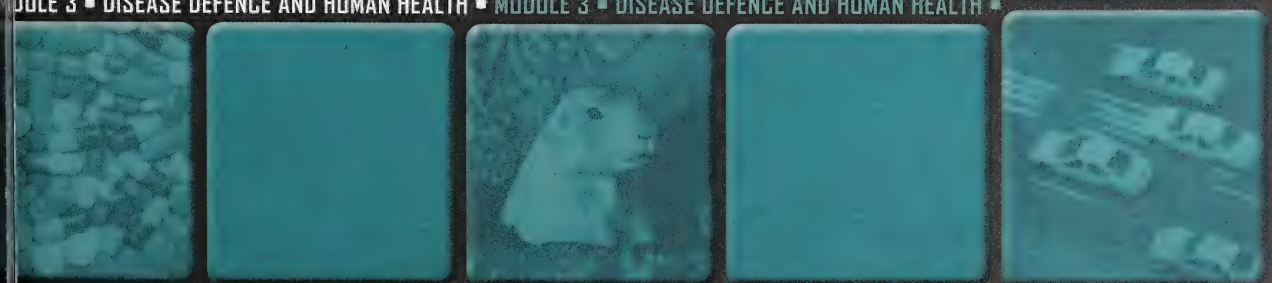


APPENDIX ■

GLOSSARY ■ SUGGESTED ANSWERS ■ IMAGE CREDITS

ND HUMAN HEALTH ■ MODULE 3

DULE 3 ■ DISEASE DEFENCE AND HUMAN HEALTH ■ MODULE 3 ■ DISEASE DEFENCE AND HUMAN HEALTH ■



Glossary

acquired immunity: immunity that develops in the body during a person's lifetime

active immunity: immunity built up by the body

amniocentesis: a procedure used to determine the chromosomal make-up of a fetus

antibody: a protein compound produced by white blood cells that binds to specific antigens

antibiotic: a drug that fights bacterial infections

antigen: a substance that stimulates the production of antibodies

aseptic: free of pathogens

bacteria: a group of single-celled organisms that may be beneficial or harmful

botulism: a form of food poisoning caused by bacterium

communicable disease: a disease that can be passed from one organism to another

disease: an illness that prevents normal functioning of the body

dominant trait: a trait that appears in offspring

epidemic: an outbreak of a disease that spreads quickly through a population but is not as widespread as a pandemic

fungi: organisms that live off dead or decaying organisms or off living organisms

e.g., moulds, yeasts, and mushrooms

genetic disorder: a condition that results from alteration to genes

genetic engineering: transferring genes from one organism to another

genome: the set of genetic instructions that make you what you are

genotype: a combination of genes

heredity: the passing of traits from parents to offspring

hybrid: offspring that carry both dominant and recessive genes for a trait

inflammatory response: swelling and increasing redness of an area around an injury or infection

inherited immunity: immunity you are born with

immune system: a line of defence of the body in which antibodies are produced and maintained to fight particular pathogens

immunity: resistance to disease

macrophage: a specialized white blood cell that surrounds and destroys damaged cells and pathogens

mutagen: an environmental factor that causes mutation

mutation: a change in genetic information that results in an abnormal gene

non-communicable disease: a disease that cannot be passed from one organism to another

over-the-counter drug: a medication that can be purchased and used without a doctor's prescription

pandemic: an outbreak of a disease that is widespread, affects a large portion of the population, and is difficult to control

passive immunity: immunity that results from antibodies introduced to the body

pasteurization: a process in which food is heated to kill microbes that will cause it to spoil

pathogen: any of a number of disease-causing agents or microbes

parasite: a living organism that gets its nourishment from a host organism

pedigree: a diagram showing the history of a trait from generation to generation

physical defence: the first line of defence against disease involving structures that provide physical barriers to pathogens

poverty: a situation where basic needs for food, clean water, health care, and education are not available

protist: a single-celled organism that has characteristics of both plants and animals

purebred: an organism that has identical genes for each trait

public health: government and other groups working together to protect the health of the community

Punnett square: a diagram used to predict the probability of offspring inheriting certain traits

quarantine: restrict to a given location while affected by a serious disease

recessive trait: a trait that does not appear in offspring unless both parents have the trait

salmonellosis: a food poisoning caused by a bacterium

staph bacteria: a bacteria that causes food poisoning

sterilization: a process used to destroy microbes

vaccination: an injection of a small dose of weakened or dead pathogens of a particular disease so an individual will build up an immunity to that disease

virus: a microscopic, non-cellular, disease-causing agent

Suggested Answers

Section 1: Lesson 1

1. *Disease* is something that prevents the normal functioning of the body.

2. Three causes of disease other than pathogens are

   - poor environment
   - genetics
   - a combination of factors including environment, diet, lifestyle, genetics, pathogens, and stress

3. Pathogens may live in toilets, air conditioners, and dirty washcloths.

4. Pathogens can be reduced or kept in check by regular cleaning.

5. Louis Pasteur discovered that microbes can be destroyed by heating. This technique is called pasteurization.

6. Bacteria, viruses, fungi, and protists are all pathogens.

7. No, not all bacteria are harmful. One bacterium that is beneficial is the one that causes milk to go sour. It is used to make yogurt.

8. Warm temperature, moisture, and the presence of food are three conditions that cause bacteria to reproduce quickly.

9. You can slow bacterial growth on fresh meat by putting the meat in the refrigerator.

10. Viruses multiply by taking over other living cells. Viruses use parts of the cell to reproduce.

11. The HIV virus that causes AIDS looks like a bomb or a ball with pins sticking out.

12. Ways in which an uninfected person can be contaminated with HIV are

    - having unprotected sexual intercourse with an infected person
    - sharing intravenous needles
    - receiving a transfusion of blood infected with HIV
    - moving through the birth canal of a mother infected with HIV

13. a. **Textbook questions 1 and 2 of "Analyze," p. 161**

    1. The yogurts are the same in that both are made from live yogurt culture. Both are made with pasteurized milk. The yogurts are different in that the store-bought yogurt is thicker. However, the yogurt made in the lab may thicken after a few days.

    2. It was important to wash your hands and sterilize all equipment before starting the investigation so you didn't introduce any other live bacteria to the yogurt.

    b. **Textbook questions 3 to 7 of "Conclude and Apply," p. 161**

    3. You heated the milk to 85°C to kill all the live bacteria that may be present. This is similar to the process of pasteurization done at commercial factories.

    4. You cooled the milk before adding the yogurt culture because heat would kill the live yogurt culture you added to make the yogurt.

    5. The environmental conditions favourable for the growth of bacteria are

        - food (milk)
        - warm temperature (placed in the incubator at 40°C to 45°C)
        - moisture (provided by the milk)

    6. The bacteria that is already present in the raw hamburger would multiply quickly, spoiling the hamburger.

    7. You may contaminate your food or drinks with the pathogens you create in a lab. You may also accidentally ingest some of the pathogens. Any pathogen created in a lab facility needs to be properly disposed of. Most school labs do not have the facilities to dispose of biologically hazardous materials.

14. "Ring around the rosies" referred to the rings around the rose-coloured rashes on the skin. "A pocket full of posies" referred to the posies (a flower) that were brought in to prevent the spread of the disease; however, they were most likely brought in as an air freshener. "Atish-oo, Atish-oo" referred to the sneezing caused by the bubonic plague. "We all fall down" referred to the death of the many people who contracted the bubonic plague.

15. a. Agar is used to grow bacteria.

    b. Millions of bacteria grow in a single colony.

16. a. Bacteria live in the air, in soil, on your skin, in your body, and in food.

    b. The tetanus bacteria lives in the soil.

    c. Bacteria oxidize the sulfides that trap gold to get energy. This allows the small amounts of gold to be released and collected.

17. a. This bacterium causes milk to go sour and makes yogurt taste tangy.

    b. Salmonella is the bacteria that may be present in chicken.

    c. You can prevent salmonella from causing you harm by thoroughly cooking the chicken and by cleaning all counters and utensils that were in contact with the raw chicken.

18. a. Bacteria can be beneficial in producing sour milk and yogurt, in decomposing food, in providing nutrients for legumes, in providing immunization against diseases, and in providing antibiotics.

    b. Bacteria can be harmful in spreading salmonella, in causing food to rot, in causing infections, and by indirectly causing harmful reactions to some antibiotics.

19. a. Bacteria divide every 12 to 20 minutes.

    b. It took the E. coli bacteria 4 hours 30 minutes to fill the petri dish.

20. a. Staph, hemophillus, and strep were grown.

    b. The incubator was used to provide the warm temperature required to promote the growth of bacteria.

21. a. Two common protists are the amoeba and the paramecium.

    b. Three serious diseases caused by protists are malaria, African sleeping sickness, and amoebic dysentery.

22. a. *Giardia* is the protist that causes beaver fever.

    b. You can avoid beaver fever by drinking water that is safe and by washing your hands thoroughly after using the toilet and before and after handling food.

23. a. Fungi live on a host because they cannot make their own food.

    b. Mushrooms are fungi people eat.

    c. Athlete's foot and ringworm are two skin diseases caused by fungi that live on the human body.

24. The balloon expands. A gas is released by the yeast, sugar, and water mixture. This gas causes the balloon to expand.

25. **Textbook questions 1 and 4 of "Check Your Understanding," p. 162**

    1. Answers will vary. Your answer should include three of these factors with an example for each.

        - **environment:** An unclean environment that harbours disease pathogens will cause increased occurrence of disease. Also, a polluted environment can lead to various diseases. Examples are colds, influenza, and emphysema.

        - **diet:** A poor diet causes the body to lack certain disease-fighting elements. Also, a poor diet, such as one with a high-fat content, can lead to organ failure. Examples are osteoporosis and heart disease.

        - **lifestyle:** An unhealthy lifestyle, such as smoking, excess alcohol consumption, and drug abuse, can lead to organ failure. Examples are various types of cancer, liver disease, and heart disease.

        - **genetics:** People can inherit some diseases. An example is muscular dystrophy.

        - **pathogens:** Pathogens, such as bacteria, viruses, protists, and fungi, can cause diseases. Examples are gingivitis, influenza, colds, AIDS, beaver fever, and athlete's foot.

        - **stress:** Increased stress may lower the body's resistance to disease. This increases your chances of catching a cold or flu. Also, increased stress can cause high blood pressure or heart disease.

    4. Raw hamburger sitting on a counter for a few hours can provide ideal growing conditions (moisture, sufficiently warm temperatures, and a food source) for bacteria to multiply quickly.

Section 1: Lesson 2

1. Your completed table should be similar to the following.

Unknown Solutions	Colour Before Germ Indicator	Colour After Germ Indicator
#1 and #2	clear	pink
#1 and #3	clear	clear
#2 and #3	clear	pink

2. Solution 2 is the one that contains the virus because the solutions that contained unknown solution 2 both changed colour when the germ indicator solution was added.

3. A communicable disease is a disease caused by a pathogen that can be passed from one organism to another.

4. A non-communicable disease is a disease that is not caused by a pathogen and cannot be passed from one organism to another.

5. A communicable disease is different from a non-communicable disease in that the communicable disease is caused by pathogens and can be passed from one organism to another. A non-communicable disease is not caused by pathogens and cannot be passed from one organism to another.

6. Communicable diseases can spread through the air, in water, in food, and through direct contact.

7. a. Botulism and salmonella spread through food when food is not handled properly, not preserved properly, or not stored properly.

   b. Botulism causes double vision and difficulty in speaking, breathing, and swallowing. Salmonella causes fever, headaches, nausea, vomiting, and diarrhea.

8. a. Meningitis spreads through direct contact with an infected person or through the handling of objects that were handled by an infected person.

   b. Meningitis causes severe headache, high fever, vomiting, neck stiffness, and joint pain.

9. A clean environment prevents the spread of communicable diseases by reducing the number of pathogens.

10. Bathrooms, especially, have to be kept clean because many pathogens are present in feces.

11. People working in the food industry—cooks, waiters/waitresses, etc.—need to take special precautions in their work.

12. Food poisoning is an illness that results from eating food that is infected with harmful micro-organisms.

13. Chicken is one meat that needs special care when handling and preparing.

14. **Textbook question "Reading Check," p. 165**

    Factors that affect the risk of developing a non-communicable disease are bad environmental conditions, poor diet, unhealthy lifestyle, and genetics.

15. Emphysema can result from polluted air.

16. Heart disease can result from a diet high in fat and cholesterol.

17. Excess strain on the heart and Type II diabetes may result from being overweight.

18. Genetics (inherited characteristics) is associated with diseases like cystic fibrosis.

19. Approximately 1.5 million children in Canada go to school hungry.

20. Malnourished children are more likely to get sick.

21. **Textbook questions 1 and 2 of "Check You Understanding," p. 165**

    1. A communicable disease is a disease caused by pathogens. It can be spread from one organism to another. Examples of communicable diseases include the common cold, the flu, chicken pox, smallpox, tuberculosis, typhoid fever, dysentery, illness caused by E. coli, botulism, salmonella, beaver fever, athlete's foot, ringworm, meningitis, sexually transmitted diseases (STDs), and AIDS.

    2. A non-communicable disease is a disease that is not caused by a pathogen. It also cannot be spread from one organism to another. Examples include arthritis, cancer, diabetes, emphysema, heart disease, and cystic fibrosis.

Section 1: Lesson 3

1. The life expectancy of the average Canadian is approximately twice the life expectancy of the average person in Sierra Leone.

2. The life expectancy of the average Canadian is so much higher than that of the average person in Sierra Leone because the living conditions in Canada are much better.

3. a. In Sierra Leone, 42% die from communicable diseases.

   b. The percentage of people who die of communicable diseases in Sierra Leone is seven times higher than the percentage of people who die of communicable diseases in Canada.

4. No, more people in Canada die of non-communicable diseases because they live much longer. Because many people in Sierra Leone die sooner of communicable diseases (and other causes), they do not live long enough to develop non-communicable diseases.

5. Risk factors are reasons you might become ill.

6. The types of risk factors are the same for people in Canada as for the people in Sierra Leone.

7. a. obesity, diabetes, heart disease, cancer, tuberculosis

   b. diarrhea, tuberculosis, and parasites

   c. emphysema, bronchitis, respiratory diseases, arteriosclerosis (and other circulatory diseases), and cancer

8. a. economic

   b. economic and social

   c. social

9. a. $$\text{percentage} = \frac{1 \text{ billion}}{6.3 \text{ billion}} \times 100\%$$
   $$= 16\%$$

   About 16% of the people in the world lack clean water.

b. $$\text{percentage} = \frac{2 \text{ billion}}{6.3 \text{ billion}} \times 100\%$$
$$= 32\%$$

About 32% of the people in the world lack toilets.

10. People in Canada might be at risk of contracting a communicable disease associated with the risk factor of drinking unclean water if a natural disaster, such as a flood, occurs. People in Canada are also at risk if the system of providing clean water breaks down.

11. **Textbook questions 1, 3, and 4 of "Check Your Understanding," p. 167**

    1. Poverty is when people in a country or region of a country do not meet their basic needs of food, water, health care, and education.

    3. Safe water for drinking and washing is essential for good health. People who live in countries that can provide safe water have lower numbers of people with communicable diseases.

    4. Non-communicable diseases kill most people in both poor and rich countries. However, in poor countries communicable diseases kill almost as many people as non-communicable diseases. Many die of communicable diseases in these countries because of poor living conditions, malnutrition, and unclean water.

Section 1: Lesson 4

1. The bacteria that causes food poisoning through coughing, sneezing, or poor handling of food is *staphylococcus* bacteria, or staph bacteria.

2. Food handlers can wear rubber gloves to prevent the spread of staph bacteria.

3. Botulism is a serious type of food poisoning because the bacterium can grow in the absence of air and produce the deadliest toxin known.

4. The purpose of food preservation is to prevent or limit the growth of pathogens that cause food poisoning.

5. a. Smoking or drying food removes moisture so pathogens cannot grow.

   b. Salting food removes moisture from cells and creates conditions that allow for a low pH that is inhospitable for bacterial growth.

c. Vacuum packaging removes the air from inside the package, preventing most bacteria from multiplying. Some botulism bacteria, however, reproduce well in a low-oxygen environment and can cause food poisoning in vacuum-packed foods.

d. Irradiation is a process that exposes food to certain forms of radiation energy. Radiation energy destroys all pathogens in foods.

6. Answers will vary. A sample answer is provided.

Aboriginal peoples used various methods to preserve foods. These methods included drying fish and meat in the sun, mixing meats with berries and coating them with melted fat before burying (pemmican), and smoking fish and meats.

Pemmican was made with buffalo, moose, or elk. Drying was done by hanging the meat on willow racks in the sun and wind. To make pemmican, the meat was then further dried over a fire until the meat was brittle. It was then pounded into a powder and mixed with fat. The mixture was then wrapped in a rawhide bag and buried. Once made, this type of pemmican could last for thirty years. Some pemmican, called seed pemmican, was made by adding berries to the pounded meat and fat mixture. Berries included cranberries, saskatoons, blueberries, and chokecherries. This improved the texture but caused the pemmican to spoil more quickly.

Fish and meats were dried on willow racks in the sun or smoked over wood fires.

7. Your completed table should be similar to the following.

Food	How to Prepare	How to Keep Safe	Type of Food Poisoning Possible
chicken wraps	• Prepare chicken on its own cutting board. • Cook chicken thoroughly. • Cool and refrigerate. • Wash thoroughly after use.	• *Pack in cooler with ice pack.* • *Choose a shady spot for the picnic.* • *Do not leave out in hot weather for more than 1 hour.*	*salmonella*

coleslaw with dressing	• Cut cabbage and carrots on clean cutting board. • Prepare dressing, mix, and refrigerate.	• Pack in cooler with ice pack. • Choose a shady spot for the picnic. • Do not leave out in hot weather for more than 1 hour.	salmonella or staph bacteria
homemade canned black-bean salsa	• Keep in sealed container until ready to use.	• Pack in cooler. • Do not leave open for more than 1 hour in hot weather.	botulism
coconut cream pie	• Prepare in clean work area. • Keep refrigerated.	• Keep in cooler until ready to use. • Do not leave out in hot weather for more than 1 hour.	staph bacteria
lemonade	• Prepare with cold water and ice.	• Keep in cooler until ready to use.	none
fresh strawberries	• Wash and pack into a container. • Keep refrigerated.	• Keep in cooler until ready to use. • Do not leave out in hot weather for more than 1 hour.	none, but could grow mould after a day or two

8. **Textbook questions 1 and 2 of "Analyze," p. 169**

    1. a. The picnickers might get botulism if the canned salsa is two years old and the seal is broken.

       b. The symptoms of botulism are double vision and difficulty speaking, breathing, and swallowing.

    2. Don't eat potato salad that has been sitting out in hot weather for several hours. The eggs and mayonnaise used to make it are good places for salmonella and staph bacteria to grow.

9. Many people who went into hospitals 200 years ago died because the hospitals were unsanitary and patients contracted diseases and infections from others.

10. Florence Nightingale reduced the death rate in hospitals by making sure patients and hospital areas were kept clean, by improving water quality for patients, and by bandaging open wounds.

11. Joseph Lister reduced the risk of infections during surgeries by spraying carbolic acid on patients before surgery and into the air where the surgery was to take place.

12. Keeping a hospital aseptic means keeping it free of pathogens.

13. Three aseptic practices are

    - using sterile bandages, instruments, linens, masks, and clothing during surgery
    - scrubbing all exposed skin of the surgeon before and after surgery
    - having all surgical staff wear rubber gloves to prevent the spread of pathogens that may be present under fingernails

14. Four common disinfectants are iodine, chlorine, bleach, and antibacterial soaps.

15. People first recognized the need for cleanliness in hospitals in the Middle East.

16. Triclosan is used as a disinfectant in many products, such as antibacterial soaps, toothpastes, mouthwashes, deodorants, and outdoor clothing. Medical specialists now feel that the overuse of triclosan may cause more harm than good. The heavy use of the disinfectant may increase the numbers of more-resistant strains of bacteria, may destroy too many of the good bacteria, and may result in bacteria to be resistant to drugs.

17. Answers will vary. A sample procedure is given.

Procedure:

step 1: Set up eight test tubes in a test tube rack. Use one as a control.

step 2: Add 1 mL of each antiseptic or disinfectant to each test tube. Add 1 mL of distilled water to the control test tube.

step 3: Obtain 20 mL of yeast solution from your teacher.

step 4: Add 2–3 mL of yeast solution to each test tube. Allow the yeast solution to sit in each product for about 15 minutes.

step 5: Add a drop of methylene blue indicator to each test tube.

step 6: Place a drop of each solution on a microscope slide and place a slipcover on it.

step 7: View each slide under the microscope. Mark the appropriate column in the table to indicate the level of microbes killed (number of blue microbes viewed).

step 8: Dispose of each solution, as instructed by your teacher, and clean all apparatus.

18. Your completed table should be similar to the following.

Product Tested	No Microbes Killed	Few Microbes Killed	Many Microbes Killed
toothpaste		✓	
mouthwash			✓
hydrogen peroxide			✓
rubbing alcohol			✓
bleach			✓
antibacterial soap			✓
baking soda	✓		
water	✓		

19. The antiseptics and disinfectants in order of effectiveness are bleach, hydrogen peroxide, rubbing alcohol, mouthwash, antibacterial soap, toothpaste, baking soda, water.

20. **Textbook questions 2 and 3 of "Check Your Understanding," p. 171**

    2. Recommendations for protecting food preparation surfaces and utensils from contamination are as follows:

        - Wash work surfaces before and after food preparation with warm, soapy water.
        - Wash hands before and after handling raw meats, seafood, and eggs.
        - Sanitize surfaces with chlorine (bleach), particularly after cutting chicken.
        - Sanitize washcloths with chlorine (bleach).
        - Wear protective clothing (rubber gloves) when handling food.

    3. An antiseptic can be used to treat open cuts and wounds, whereas a disinfectant can be used to disinfect objects, such as scissors, that may be required to treat an open wound.

Section 1 Review

1. **Textbook question 1 of "Reviewing Key Terms," p. 172**

a. communicable	b. botulism	c. pasteurization
d. disease	e. staph bacteria	f. salmonellosis
g. non-communicable	h. sanitary	i. pathogens
j. poverty	k. sterilization	l. aseptic

m. bacteria, viruses, protists, and fungi

2. **Textbook questions 3, 4, and 9.a. of "Understanding Key Ideas," p. 172**

    3. Factors that cause disease include pathogens, lifestyle, diet, environment, stress, and genetics.

    4. Bacteria need moisture, warm temperatures, and a food source to grow (multiply).

    9. a. The purpose of using aseptic techniques is to keep hospitals, equipment, and staff free of pathogens.

3. **Textbook question 11 of "Developing Skills," p. 172**

   11. Natural disasters, such as floods, can cause sewers to back up and flood homes and businesses with contaminated water. This lack of sanitation can cause outbreaks of communicable diseases. In cases of extreme flooding, food may also become contaminated by water or airborne pathogens, which could result in starvation.

4. **Textbook question 12 of "Problem Solving/Applying," p. 173**

   12. No, it is not possible to use pasteurized yogurt to make more yogurt. Making more yogurt requires the use of a starter yogurt with living microbes in it. Pasteurization kills the microbes used to make yogurt.

5. **Textbook question 16 of "Critical Thinking," p. 173**

   16. People who travel from one country to another can spread disease in several ways. They can have various pathogens in them that they pass on to others in the areas they travel to. Also, they can bring diseases they were exposed to while travelling back to their home country. Health staff in either country may be unprepared for new, infectious diseases.

Section 2: Lesson 1

1. The Europeans brought smallpox, tuberculosis, and flu to North America.

2. These diseases affected Aboriginal society because they had never been exposed to these diseases before.

3. Three effects on Aboriginal society were as follows:

   - More people starved because there were fewer hunters.
   - The birth rate in the communities slowed because many young women died.
   - Many traditions and customs were lost because many elders died before passing on their knowledge.

4. AIDS is affecting a significant part of African society as well as many other societies today.

5. Historians learn about diseases that were widespread in the past by reading tombstones to see how many members of a family and how many families in a community died around the same time.

6. The general distributed blankets from people who died of smallpox to Aboriginals. The Aboriginals then contracted smallpox themselves and passed on the smallpox virus to others in their community. This resulted in a large number of deaths in the Aboriginal community.

7. **Textbook questions 1 and 2 of "Analyze," p. 177**

    1. Answers will vary. Sample answers are given.

        a. Here are some points that may be supported:

            - AIDS patients and those associated with the disease might be treated as potential criminals. **Reason for support:** This can be looked upon as intolerance.

            - If individuals are charged with a criminal offence involving AIDS, people will less likely come forward for testing or treatment for AIDS. **Reason for support:** As a result, people who are most in need of treatment might not get help.

            - Individual responsibility for safe practices may be undermined. **Reason for support:** People may falsely feel secure in that the law is protecting them.

        b. Here are some points that may be rejected:

            - AIDS patients and those associated with the disease might be treated as potential criminals. **Reason for lack of support:** The general public needs to be protected.

            - If individuals are charged with a criminal offence involving AIDS, people will less likely come forward for testing or treatment for AIDS. **Reason for lack of support:** Most people will get medical treatment if they need it.

            - Individual responsibility for safe practices may be undermined. **Reason for lack of support:** The general public needs to be protected.

    2. **Employer:** Reason for an employer to know is in the case of an accident. Reason for an employer not to know is that it could result in discrimination.

        Teacher: Reason for a teacher to know is in case of an accident. Reason for a teacher not to know is that it could result in discrimination.

        Sexual partner: Reason for a sexual partner to know is because the exchange of bodily fluids increases the risk of infection. Reason for a sexual partner not to know is that safe sex eliminates the danger of infection.

Member of the community: Reason for a member of the community to know is in case of accidents in sports, where bodily fluids could be exchanged. Reason for a member of the community not to know is that it could result in discrimination and could violate the individual's privacy.

Life insurance representative: Reason for a life insurance representative to know is that health information determines cost of coverage. Reason for a life insurance representative not to know is that the individual's insurance premiums are increased or the individual may be denied coverage entirely.

8. Answers will vary. A sample report is given.

The Spanish flu has occurred in three separate pandemics. The first pandemic—the one with which most people are familiar—is the 1918 pandemic. The other two occurred much more recently: 1957–1958 and 1968–1969. These two occurrences did not involve as many deaths, thus they are not considered as prominent.

In the 1918 pandemic, thousands of people died on every continent. The flu originated in Europe and had spread, in many cases, by soldiers returning to their homeland. In Canada more people died from the Spanish flu than were killed in action in World War I. In Alberta alone, 3000 people died from the Spanish flu. During the 1918 flu, many people refused to go to theatres and restaurants for fear of catching the disease. This significantly affected the economy related to those businesses. The disease was especially devastating to the economy because the virus struck, most often, those who were the healthiest—young adults.

The 1957–1958 and 1968–1969 pandemics were bird viruses that were related to the Spanish flu pandemic of 1918. The 1957–1958 flu was called the Asian flu, and the 1968–1969 flu was called the Hong Kong flu. It is thought that another outbreak may occur. The avian flu in 2004 is another variation of a bird virus. Humans have contracted the avian flu only from direct contact with infected birds, but this version of the virus does not spread from human to human. However, this virus could make the leap from birds to humans if it mutates (changes) enough. Some health professionals think that a mutation of an avian flu in humans may be less severe because of the mutations. Others think that since there is little or no immune system protection in humans for variations of this virus, an influenza pandemic could develop.

The centres for disease control in developed countries and the World Health Organization continually monitor the emergence of new viruses. Early detection and action could prevent the occurrence of another pandemic, like the Spanish flu of 1918.

9. A pandemic disease affects a larger proportion of the world population and is more difficult to control than an epidemic disease.

10. The pandemic and epidemic diseases of the past seven centuries were the Bubonic Plague Pandemic (1346–1350), the Tuberculosis Epidemic (1500s–1700s), the Spanish Flu Pandemic (1918), and the AIDS Pandemic (1980s to present).

11. a. Tuberculosis is a bacterial disease that damages the lungs. It was common in Europe in the 1500s to the 1700s. In Canada tuberculosis has caused many deaths among Aboriginals and Inuit.

    b. AIDS is a viral disease that weakens the body's ability to fight infection. AIDS was officially recognized in 1980 and is increasing in severity around the world. In Canada there is a 10% increase in new AIDS infections each year.

12. Five social conditions that contributed to the Bubonic Plague Pandemic were

    - overcrowded cities
    - limited clean water
    - no waste disposal
    - poor sanitation and hygiene
    - high population of rats that carried the disease

13. A *quarantine* is when people (or animals) with a contagious disease are isolated or restricted from having contact with those who do not have the disease.

14. a. In western Canada, 25% of Aboriginal and Inuit children in residential schools died of tuberculosis in the early 1900s.

    b. Tuberculosis caused many Aboriginals and Inuit to be sent to special treatment centres called sanatoriums. This resulted in many children being put up for adoption instead of returning to their families and many adults losing contact with their communities.

15. Effects AIDS is having on the world population today are as follows:

    - AIDS has become the fourth leading cause of death worldwide.
    - Costs for treatment are high, and there is no cure at this time.
    - Fear and confusion about AIDS has resulted in the negative treatment toward those who are infected.

16. People realized there was a connection between sanitation and disease after they began cleaning up the streets. Communities became healthier.

17. Public health is people working together to develop healthy communities.

18. In "The Year of the Great Stink," the English government got involved in public health and started fining people for dumping waste and raw sewage into the Thames River.

19. Some countries still have cesspits where people can dump raw sewage. Sometimes these cesspits overflow and spill sewage into the streets.

20. **Textbook questions 1 and 4 of "Check Your Understanding," p. 180**

    1. An epidemic becomes a pandemic when the disease becomes widespread over a large geographic area and becomes hard to control.

    4. Answers will vary. The following is a sample answer for typhoid fever.

       Typhoid fever is a bacterial infection that spreads through the ingestion of food or water contaminated with excreta from a person who has or from a person who is a carrier of the disease. In most countries the disease has been controlled by improved sanitation. Symptoms of typhoid fever include coughing, vomiting, headache, diarrhea, abdominal pain, and anorexia.

       Vaccinations are available for typhoid fever; and with modern sanitation, most developed countries have all but eliminated the disease.

Section 2: Lesson 2

1. The first department of health in Canada was established in 1919.

2. Three jobs done by provincial health departments are

   - monitoring the safety of drinking water
   - checking pollutants in the air
   - taking measures to avoid outbreaks of disease

3. The public health service in Alberta is called the Regional Health Authority.

4. Six services provided by public health organizations are

   - checking water quality
   - monitoring landfill sites
   - monitoring the treatment of human and animal wastes
   - monitoring air quality
   - providing mass vaccinations
   - promoting food safety awareness and monitoring the food service industry

5. Public health organizations test beach water in lakes on a regular basis to ensure the bacteria count does not reach dangerous levels. Health authorities will close the beach if bacteria levels get too high.

6. Health Canada developed the guidelines that list allowable levels of pollutants in the air you breathe.

7. People are told to avoid heavy physical exercise when pollution levels are high because heavy physical exercise increases the body's need for oxygen. Oxygen may be difficult to get when pollution levels are high.

8. Public health organizations provide services with regard to vaccinations such as

    - vaccinating children to fight diseases, such as diphtheria, whooping cough, measles, mumps, tetanus, polio, and rubella

    - vaccinating travellers for various diseases known to the country the travellers wish to visit (A fee may be charged for some of these vaccinations.)

    - developing new vaccinations as the need arises and providing them free to those who are at risk

9. The *Fight*BAC! campaign promotes these points:

    - **clean:** Wash hands and surfaces often.

    - **cook:** Cook foods to proper temperatures.

    - **separate:** Do not cross-contaminate. Use different cutting boards for meats and vegetables.

    - **chill:** Refrigerate promptly.

10. The heading means that you, as an individual, can make a difference in staying healthy.

11. You can help yourself and others stay healthy by maintaining a high standard of personal hygiene and by preventing the spread of germs when you get ill. You can also enrol in training programs that will help you protect the health and safety of yourself and others.

12. **Textbook questions 1, 2, 3, and 5 of "Check Your Understanding," p. 183**

    1. The role of public health in Canada is to provide programs and services that will protect and improve community health. The programs and services include those associated with water quality, removal of garbage, treatment of human and animal wastes, air quality, mass vaccinations, and food safety.

    2. Chlorine is used to treat water in swimming pools and drinking water because it is a very good disinfectant (kills bacteria).

3. a. High standards of personal hygiene will help remove bacteria from each individual's hands and help prevent bacteria from entering their systems.

   b. If all or many individuals of a community have high standards of personal hygiene, this will help prevent the spread of bacteria in the entire community. This will result in a healthier community with lower health care costs overall.

5. Answers will vary. The following points should be included in your paragraph or discussion.

   - having a high standard of personal hygiene
   - following the public health standards regarding water quality and food safety
   - disposing garbage properly
   - following the public health standards with regard to human and animal wastes
   - getting the necessary vaccinations

Section 2: Lesson 3

1. Smallpox has been eliminated from most countries.

2. People still need to follow public health guidelines because some old diseases, once thought to have been eliminated, are resurfacing. Also, there are new communicable diseases appearing.

3. Polio and drug-resistant variations of tuberculosis have resurfaced.

4. Two new communicable diseases that have appeared in the last 30 years are AIDS and SARS.

5. a. Public health authorities are concerned with overcrowding increasing the chances of individuals being exposed to pathogens. With regard to travel, public health authorities are concerned with people having increased exposure to pathogens through such things as eating improperly prepared foods and using unsanitary washrooms.

   b. The guidelines public health authorities have established with regard to population growth and overcrowding is to advocate that good personal hygiene and the proper treatment of wastes reduces the spread of pathogens. With regard to travel, public health authorities require travellers to receive special vaccinations before travelling to some countries. They also provide travellers with brochures explaining how to protect themselves from pathogens in food and water while in the country of travel.

6. Health authorities may release food recalls, boil-water advisories, mass-vaccination advisories, and road safety warnings.

7. A boil-water advisory is issued whenever tests deem the drinking water in a city, town, or rural farm to be unsafe. In the case of the rural farm, the owner is responsible for providing a water sample for testing.

8. Public health officials encouraged legislators to pass laws requiring those under the age of 18 to wear helmets because falling off a bicycle, even at low speeds, can cause brain injuries.

9. If you ride a bicycle and have a bicycle helmet, a warning about the safety of a particular brand of bicycle helmet may affect you. Information on proper use of helmets for bicycles and seatbelts in cars may also affect you.

10. **Textbook question 1 of "What to Do," p. 186**

    1. (a) Walkerton's water supply was contaminated when heavy rains washed bacteria into the town's shallow water well.

       (b) Thousands of residents became ill with bloody diarrhea, vomiting, cramps, and fever. Seven people died.

       (c) Water samples were taken and tested within three days.

       (d) The town's public utilities commission is responsible for monitoring water quality in the town.

       (e) The water monitoring system failed in Walkerton because the commission that did the testing did not take immediate action once the contamination was discovered.

       (f) The public health centre identified the problem by testing the water. The centre protected residents by ordering a boil-water advisory as soon as they took the samples.

11. **Textbook question 2 of "Analyze," p. 186**

    2. Answer will vary. Sample answers are given for both sides of the statement.

       Agree: Human error was the main reason for the loss of human life in Walkerton. The public utilities commission took too long to test the water. They should have known that shallow wells are subject to runoff and, thus, should have tested the water immediately after it rained. Also, after the public utilities commission did find that the water was contaminated, they still did nothing about it. The public heath centre was not notified until several people became ill. At that time, the public utilities commission still claimed that the water was safe. Therefore, human error was the main cause of the loss of life in Walkerton.

       Disagree: Human error was not the main reason for loss of human life in Walkerton. The heavy rains caused bacteria to enter the shallow well that supplies the town water. The public utilities commission tested the water and found bacteria, but they felt the water was still safe to drink. Even if they had notified the public health centre that the water was contaminated, it was probably already too late as people had been using the water all along. The heavy rains that resulted in the contamination of the town's water well was the main cause of loss of life in Walkerton.

12. Figure 10.13 discusses the Canada Prenatal Nutrition Program. It educates pregnant women about lifestyle issues. It is important that pregnant women know that they need to eat properly and avoid the use of tobacco, alcohol, and drugs for the proper development of their babies.

    Figure 10.14 discusses the importance of vaccinations. It briefly discusses the importance of getting flu shots for high-risk groups and immunizing children against common diseases before they start school.

    Figure 10.15 discusses the importance of promoting health in the schools. An example is teaching school-age children about the harmful and non-glamorous effects of smoking.

    Figure 10.16 discusses the importance of keeping active and fit in the later stages of life.

13. Washing your hands is important because it removes bacteria that you could pass on to somebody else. If you have bacteria on your hands, everything and everyone you touch can get the bacteria.

14. If you make wise choices to protect your personal health, you will not pass bacteria and viruses on to others. If you make wise lifestyle choices (diet, tobacco, alcohol, etc.) and adopt safe practices with regards to driving and cycling, you will help protect yourself and your community. Overall, health costs are lower if communities are healthier and safer.

15. **Textbook questions 1, 2, and 3 of "Check Your Understanding," p. 189**

1. Factors that account for the spread of communicable diseases are

- migration
- lifestyle
- travel
- food supply
- sexual activity and child birth
- population growth and overcrowding

2. Yes, it is important to have public health guidelines. Public health guidelines provide awareness of what people should do regarding health and safety practices. Examples may include the following:

- Disease monitoring keeps an eye on the level of disease.
- Food inspectors test food for pathogens.
- Vaccinations and health information help people when they travel.
- Regular restaurant inspections promote safe food-handling practices.
- Good personal hygiene and the proper disposal of wastes reduce the spread of pathogens.

3. Preventative health programs help people make good choices that, over the years, will benefit both the individual and the whole community. Costs associated with treating diseases are rising rapidly, so prevention programs that reduce the spread of diseases will be much less costly than the costs associated with treating diseases.

Section 2 Review

1. **Textbook questions 3 and 4 of "Reviewing Key Terms," p. 190**

3. A vaccination is an injection or oral liquid given to people to help their immune systems build up a resistance to a particular disease. Examples of diseases people get vaccinated against are diphtheria, hepatitis, measles, mumps, polio, rubella, tetanus, and whooping cough.

4. To be placed under quarantine means to be isolated and restricted from contacting or passing articles to those who are not under quarantine. Only authorities with special permission can enter a quarantined area.

2. **Textbook questions 5 and 6.b. of "Understanding Key Ideas," p. 190**

5. Interest in public health began when people realized there was a connection between personal and community sanitation and disease.

6. b. The bubonic plague had the following impacts on society:

- 30–50% of the population died.
- Worldwide, it is estimated that over 100 million died.
- Those with the plague were quarantined until full recovery or death.
- The crime rate decreased.

3. **Textbook questions 10 and 11 of "Developing Skills," on p. 190**

10. Answers will vary. Some possible programs are

- providing vaccinations for children and for the general public as necessary
- sending nurses to schools to talk about eating disorders, family planning, and sexually transmitted diseases
- providing low-cost or free services for blood pressure checks, hearing tests, and grief counselling
- providing prenatal classes for new parents
- renting car seats or selling car seats at cost for babies and small children

11. Lifestyles that might cause diseases to spread include

- practising poor hygiene
- eating out often, increasing the chances of catching disease through food
- travelling often, increasing the chances of the migration of disease
- engaging in unsafe sex, increasing the chance of transmitting an STD

4. **Textbook question 14 of "Problem Solving/Applying," p. 190**

14. The following are some actions you might take:

- Get all the vaccinations recommended for travel to the particular country.
- Obtain all the information available on diseases in the region.
- Practise good personal hygiene.
- Drink only safe water.
- Avoid foods that are uncooked or sold by street vendors.
- Practise abstinence or safe sex.
- Use mosquito netting at night to prevent insect bites.

5. **Textbook question 15 of "Critical Thinking," p. 191**

    15. The quarantine prevented the movement of animals off the farm and did not allow new animals on the farm. People were restricted from visiting the area where the animals were contained. Both of these actions helped prevent the spread of the disease.

Section 3: Lesson 1

1. The three lines of defence your body has against disease are physical defences, inflammatory responses, and the action of antibodies (immune system).

2. Your nose and sinuses trap pathogens with hair and mucus before they can enter the respiratory system.

3. Tonsils and adenoids catch pathogens before they enter the body. The tonsils or adenoids may become infected and help the immune system build up resistance to fight future infections.

4. Eyelids cover both eyes to protect them from pathogens as well as dust and other particles. Tears wash away pathogens and dust that have landed on the eye.

5. Eyelashes and hair catch and trap pathogens.

6. Parts of the ear contains wax that traps pathogens and prevents them from getting into the inner ear.

7. Skin provides a thick barrier with a slightly acidic surface that prevents pathogens from contacting the tissues beneath the skin.

8. The stomach contains a strong acid that kills some pathogens.

9. An inflammatory response is the swelling and increased redness of an injured area of the body.

10. Three types of inflammatory responses are as follows:

    - If the skin is cut or broken and pathogens get past this barrier, the body sends white blood cells to destroy the invading pathogens.

    - If the skin and tissue under the skin is hit and damaged causing blood to ooze from ruptured blood vessels into the surrounding tissue, white blood cells engulf the damaged cells and cell parts at the site to clean up the bruised area.

    - If an infection like tonsillitis or appendicitis appears, it triggers an inflammatory response in which white blood cells go to the site to fight the infection.

11. Physical defences and inflammatory responses are called general defences because the body reacts the same way no matter which pathogen is involved.

12. The third line of defence is the immune system (action of antibodies).

13. Macrophages are specialized white blood cells that destroy damaged cells and pathogens.

14. Macrophages destroy pathogens by engulfing them.

15. **Textbook questions 1, 2, and 3 of "What Did You Find Out?," p. 196**

    1. a. The unwashed finger produced the most bacterial growth.

       b. The cleaned finger produced the least amount of bacterial growth.

    2. Touching objects, food, or body areas with unwashed fingers promotes bacterial growth. Washing your hands discourages bacterial growth.

    3. If someone is too clean, they destroy beneficial bacteria along with the harmful bacteria.

16. **Textbook question 4 of "Check Your Understanding," p. 196**

    4. Your best defence strategy against pathogens is to keep cool, dry, and clean. This particularly applies to such areas as between fingers and toes and anywhere there are folds of skin.

Section 3: Lesson 2

1. Immunity is a resistance to a disease.

2. Antigens are substances that stimulate the production of antibodies. **Note:** The textbook definition of *antigen* is specific to disease-causing agents. Antigens can include foreign blood cells and cells of transplanted organs.

3. Antibodies are Y-shaped protein compounds produced by white blood cells that attach to specific antigens.

4. Once you have a disease, your body produces antibodies against the antigen of that particular disease. Next time you are in contact with the same disease, your body already has the antibodies against that disease so it can start fighting the disease right away.

5. Each antibody has a shape that matches a specific antigen.

6. No, Antibody Type B cannot attach itself to the antigen marker for this pathogen because it is not the right shape.

7. No, the shape of the antigen marker for chicken pox is different from the antigen marker for measles. Some diseases, like chicken pox and cowpox, have similar antigen markers.

8. a. Anti-rejection drugs are drugs given to patients who have had an organ transplant so their body will not reject the organ.

   b. A problem with anti-rejection drugs is that the person's immune system usually shuts down when they are given the drug. This makes the person less resistant to pathogens.

9. The macrophage engulfs the bacterium when it first encounters it.

10. a. Helper T cells identify the antigens from the bacterium.

    b. The antigens from the bacterium stick out of the macrophage. This makes it easy for T cells to identify them.

11. B cells produce the antibodies that attach to antigens. Macrophages then recognize the antibodies and destroy the antibody and the attached pathogen. (Refer to Figure 11.5 on page 198 of the textbook.)

12. Memory cells store information about the antigen of the invading pathogen. This makes it easier to destroy the pathogen next time it enters the body.

13. You are born with inherited immunity. This type of immunity refers to a general resistance that all organisms have to most diseases.

14. Acquired immunity is built up from birth.

15. Two types of acquired immunity are active immunity and passive immunity.

16. You get active acquired immunity through your body making its own antibodies. It can be naturally developed as when you contract a disease; or it can be artificially introduced as when you get a vaccination.

17. You get passive acquired immunity when antibodies are introduced into the body. It can be obtained naturally, such as babies receiving natural immunity through breast-feeding; or it can be introduced artificially, such as injecting an antitoxin made from snake venom to build up a resistance to a particular snake bite.

18. Viruses are pathogens that cause disease in humans. They are made up of genetic material surrounded by a protein coat.

19. Scientists can distinguish the AIDS virus from the polio virus by their shapes.

20. Viruses reproduce in host cells.

21. The five stages in the life cycle of a virus are attachment, infection, takeover, production, and rupture.

22. The host cell dies at the end of the virus's life cycle.

23. During the infection and takeover stages in the life cycle of a virus, the chromosome-like structure from the virus released in the host cell replaces the genetic material of the host cell. The host cell then produces more viruses.

24. Macrophages are called the soldiers of the immune system because they destroy invading pathogens.

25. The AIDS virus causes death by destroying the immune system of the person it has invaded. This causes the person to die of a disease that normally the immune system of a healthy person would have faught off.

26. Your completed table should be similar to the following.

Simulated Blood Type	Reaction with Simulated A Antibodies	Reaction with Simulated B Antibodies
Type A	clumps formed	no clumps
Type B	no clumps	clumps formed
Type AB	clumps formed	clumps formed
Type O	no clumps	no clumps

27. a. **Textbook question 1 of "Analyze," p. 200**

1. a. No clumps formed when Type A blood and B antibodies were mixed.

   b. The blood cells clumped together when Type A blood and A antibodies were mixed.

   c. No clumps formed when Type B blood and A antibodies were mixed.

   d. The blood cells clumped together when Type B blood and B antibodies were mixed.

   e. The blood cells clumped together when Type AB blood and either A or B antibodies were mixed.

   f. No clumps formed when Type O blood and either A or B antibodies were mixed.

b. **Textbook questions 2 and 3 of "Conclude and Apply," p. 200**

2. Mixing blood types causes clumping. If the clumping of blood occurs in the blood vessels and organs, this can clog blood vessels and slow or stop blood circulation.

3. Type O blood does not clump with either A or B antibodies, so it can be given to a person with any blood type.

28. **Textbook questions 1 and 3 of "Check Your Understanding," p. 201**

1. Antibodies are specific to certain antigens. The end structure of the antibody must be of the same shape as the shape of the antigen. In the diagram, the shapes are not the same, so this antibody will not attach itself to the antigen.

3. In active immunity the body makes its own antibodies, whereas in passive immunity the antibodies are introduced to the body. Also, active immunity is usually permanent, whereas passive immunity will last for only so long.

   Examples of active immunity include

   - immunity to chicken pox, measles, or mumps once you have had the disease
   - immunity to a flu, hepatitis B, polio, or smallpox once you have been given a vaccine for each disease

   Examples of passive immunity include

   - immunity to some diseases acquired through breast milk
   - immunity to a particular snake bite through antitoxin injection

Section 3: Lesson 3

1. A vaccine is made up of weakened or dead disease pathogens.

2. Once you get a vaccination, your body begins to produce antibodies against the antigens in the vaccine.

3. You don't get the disease from the vaccination because the pathogens in the vaccine are weakened or dead.

4. Injections for tetanus or diphtheria are different in that they contain antitoxins drawn from animal blood. The antioxins neutralize the effect of a toxin and act quicker than vaccines.

5. Most Canadians are immunized against diphtheria, measles, mumps, polio, rubella, tetanus, and whooping cough.

6. You got your antibodies from your mother when you were born.

7. Breast-feeding provides babies with even more antibodies.

8. Some people do not get immunizations because they may have serious reactions to the vaccine.

9. People should get immunizations if they can because immunizations have reduced the number of people who acquire communicable diseases. Some diseases, like smallpox, have been eliminated through immunization programs.

10. In countries where immunization programs have been limited or stopped, there have been increases in diseases that had been almost eliminated previously.

11. The immune system overreacts to a substance, such as pollen or dust, and begins to build antibodies against it. Mild symptoms are runny nose and itchy, watery eyes. More severe symptoms are difficulty breathing and even death in extreme causes.

12. The tests used to identify allergens are called scratch tests. In a scratch test, drops of an antigen are placed under the surface of scratched skin. Evidence of an allergic reaction include redness, swelling, and itching along the scratch.

13. Immunotherapy involves injections of weakened allergens on a regular basis. This will build up antibodies against the allergen over time so an encounter with a regular allergen of this type will not result in an overreaction of the immune system.

14. **Textbook questions 1, 2, and 3 of "What Did You Find Out,?" p. 203**

    1. Your presentation can be made using the chart you made in step 3 of "What to Do." Your chart should be similar to the following.

Allergen	How Common?	Symptoms	Treatment
dust mites	• very common • makes up 25–50% of allergies	• runny nose • itchy, watery eyes	• antihistamines • medicated eyedrops • avoidance of allergen
nuts	• not very common • peanut allergy not the same as nut allergy	• swelling of vocal cord or onset of shock	• CPR if nut is eaten • absolute avoidance of nuts

insect bites/ bee stings	• severe reactions not common	• swelling and redness of affected area In severe cases, • swelling of throat • hives • drop in blood pressure	• insect venom kit (syringe with epinephrine) • avoidance
fur or feathers	• fairly common (about 10% of subjects)	• runny nose • itchy, watery eyes	• allergy shots if a pet handler • antihistamines or decongestants for occasional contact • avoidance
pollen	• very common • higher in spring time	• sneezing • runny nose • itchy, watery eyes • headache • fatigue	• antihistamines • decongestants • stay indoors during high-pollen season

2. Allergies toward pollens occur mostly in spring time when more pollens are in the air. Allergies toward pet fur may be more prevalent in winter when pets and people are confined indoors together more.

3. Allergies are more common in children where one or both parents have allergies. Some people also develop allergies over time. Exposure to some allergens many times over several years can build up an allergic reaction in an individual.

15. Compare your completed chart with the chart in the answer to question 14. Compare your answers to questions 2 and 3 of "What Did You Find Out" with the answers in question 14.

16. **Textbook questions 1 and 3 of "Check Your Understanding," p. 203**

    1. Vaccines prevent disease by putting antigens into your body to get your body producing antibodies to the disease.

    3. If a child is exposed to whooping cough and develops the disease, it could spread quickly through others in the community.

Section 3: Lesson 4

1. There is no vaccine for the common cold because there are so many common cold viruses. Cold viruses keep mutating (changing). As soon as you have a vaccine for one cold virus, new cold viruses resistant to the vaccine arise.

2. Over-the-counter drugs are drugs that treat the symptoms of a cold or allergy and can be purchased without a prescription.

3. An antibiotic can fight infections caused by bacteria.

4. Fungi, moulds, and bacteria are used by scientists today to develop antibiotics.

5. Sir Alexander Fleming noticed there was no bacteria growing close to mould that was growing in his dishes of bacteria.

6. People are often demanding antibiotics for every cold and sore throat they get.

7. Three problems associated with the overuse of antibiotics are as follows:

    - The antibiotics kill both harmful and helpful bacteria.
    - Antibiotics can cause side effects for some people.
    - Overuse of antibiotics can help the development of resistant bacteria.

8. Antibiotic-resistant bacteria develop when some mutated bacteria survive the antibiotic and reproduce. The new strain of antibiotic-resistant bacteria may infect other people and may not be controllable by antibiotics.

9. Lysozyme—present in sweat, tears, and saliva—is a natural antibiotic.

10. Scientists test new antibiotics by

    (1) growing bacterial colonies in a petri dish

    (2) introducing small samples of the antibiotic

    (3) observing whether "no-growth" zones (halos) develop

    (4) measuring the size of the "no-growth" zones to determine the effectiveness of the antibiotic

11. a. Amoxicillin was most effective against the strep bacteria.

    b. The control indicated that it is the antibiotics that are forming the "no-growth" areas.

12. Erythromycin was most effective against the staph bacteria.

13. Penicillin was most effective against the hemophilus bacteria.

14. A doctor might prescribe an antibiotic that is not the most effective against a particular bacteria because the patient may be allergic to the most effective antibiotic.

15. Three ways in which bacteria are beneficial for humans are as follows:

    - Bacteria are used to make food, like yogurt.
    - Bacteria recycle nutrients in soil.
    - Bacteria are used to make antibiotics.

16. Two ways in which bacteria are harmful for humans are as follows:

    - Bacteria cause disease.
    - Bacteria spoil human food supplies.

17. To take antibiotics safely, you should do the following:

    - Ask your doctor or pharmacist questions about the antibiotic.
    - Read the label carefully to find out how and when to take the antibiotic.
    - Take the drugs properly (as prescribed on the label).

18. The label on a bottle of medicine tells you whether to take the medicine with food or on an empty stomach, if the medicine causes sensitivity to sunlight, what time of the day and how often to take the medicine, and the expiration date of the medicine.

19. Patients may have combined medicines improperly, have an allergic reaction to the medicine, or have other side effects to end up in the hospital.

20. Even though the symptoms may be the same, the ailment may be different from those you've had before.

21. You should read the label to find out which symptoms the drug treats, which side effects may occur, and how much of the drug you should take and how often.

22. Many over-the-counter drugs can cause drowsiness, making the operation of a motor vehicle unsafe for you and others.

23. The following is a sample table for a pain reliever and two cold remedies.

Product	Medicinal Ingredients	Precautions and Side Effects	Advertising Claims	Do Ingredients Correspond with Advertising Claim?
Tylenol	• acetaminophen	• Keep out of reach of children. • Hazardous to exceed 8 caplets per day. • Consult doctor before use with other products • Chronic alcohol users may be at increased risk of liver damage.	pain and fever reliever	Acetaminophen is a pain and fever medicine.
Sinutab Sinus Allergy	• acetaminophen • chlor-pheniramine maleate • pseudo-ephedrine hydrchloride	• Do not use with other products containing this medication. • May cause drowsiness. • Do not drive or engage in activity requiring alertness.	decongestant and pain reliever	Chlorpheniramine maleate and pseudoephedrine hydrochloride are nasal decongestants. Acetaminophen is pain and fever medicine.
Vicks Dayquill Cold/Flu Relief	• dextro-methorphan hydrobromide • pseudo-ephedrine hydrochloride • acetaminophen	• Do not use with other products containing this medication. • Do not use for more than 5 days. • Do not use if you have ailments (e.g., high blood pressure, thyroid disease, and diabetes).	decongestant, cough suppressant, and pain reliever	Dextromethorphan hydrobromide is a cough suppressant. Pseudoephedrine hydrochloride is a decongestant. Acetaminophen is a pain and fever medicine.

24. **Textbook questions 1, 2, and 3 of "Analyze," p. 207**

    1. a. All products had the approved ingredients for the claimed purpose of the medication.

       b. None of the medications made unrealistic claims.

    2. a. Answers will vary. You may have used any of the three medications you listed or none.

       b. Answers will vary depending on the product you used and the results you achieved.

    3. It is important for the user to know whether the product cannot be combined with another product or that the product causes drowsiness. Also, knowing that certain side effects may occur is valuable information for the user.

25. **Textbook question 1 of "Check Your Understanding," p. 207**

    1. No, a flu is a viral infection. Antibiotics do not work against viruses.

26. Some things you need to look for when choosing an over-the-counter medication are as follows:

    - Check the expiry date.
    - Check for the symptoms the product is intended to treat.
    - Check for warnings and side effects.
    - Follow the instructions regarding the amount to use and how often.

Section 3 Review

1. **Textbook question 1 of "Reviewing Key Terms," p. 208**

    1. a. Your body recognizes substances called **antigens** that do not belong to it.

       b. White blood cells that help defend the body from pathogens are called **macrophages**.

       c. Bacterial infections can be treated with **antibiotics**.

d. An injection of dead or weakened pathogens is called a **vaccine**. **Note:** The substance injected is called a vaccine. The procedure of injecting the vaccine is called a vaccination or immunization.

e. Tears are an example of **physical defences**.

f. Medications that are not prescribed by a doctor are called **over-the-counter drugs**.

g. To resist a disease such as measles, your body produces **antibodies**.

h. The immunity that passes from a mother to her child in breast milk is called **passive immunity**.

i. The body's second line of defence against disease is called the **inflammatory response**.

j. Antibodies produced after a vaccination is an example of **active or acquired immunity**.

k. The group of defences that fight specific pathogens is called the **immune system**.

2. **Textbook questions 4 and 6 of "Understanding Key Ideas," p. 208**

4. Attached to pathogens are specifically shaped structures called antigens. Your body recognizes that antigens are not a part of the body.

6. a. Edward Jenner developed a vaccine for smallpox.

b. Jonas Salk developed a vaccine for polio.

c. Sir Alexander Fleming developed the first antibiotic, called penicillin.

3. **Textbook question 9 of "Developing Skills," p. 209**

9. When a pathogen enters the body, an inflammatory response occurs. Macrophages surround and destroy some of the pathogens. Antigens from the dead pathogens protrude through the macrophage and are identified by white blood cells called helper T cells. Then white blood cells called B cells release antibodies that attach to the antigens. Machrophages then destroy the antibody and attached pathogen. The B cells also produce memory cells that store information about the invading pathogen so it will be recognized next time it invades the body.

4. **Textbook question 11 of "Problem Solving/Applying," p. 209**

   11. Frequently using antibacterial soap could result in some resistant bacteria remaining and multiplying to produce a colony of antibacterial soap-resistant bacteria.

5. **Textbook question 14 of "Critical Thinking," p. 209**

   14. Overuse of bandages containing antibiotics can lead to antibiotic-resistant bacteria strains multiplying. If no infection develops, then the body's own defences have taken care of the invading pathogen.

Section 4: Lesson 1

1. **Textbook questions 2, 3, and 4 of "What Did You Discover?," p. 211**

   2. Answers will vary. Generally, the more dominant traits are the presence of dimples, brown/green eyes, detached earlobes, brown/black hair, short second digit finger, no freckles, thumb does not bend back, and the ability to roll the tongue.

   3. In most characteristics, the totals for Option 1 are much higher.

   4. Option 1 characteristics are more likely to occur than Option 2 characteristics.

2. Genetics is the branch of science concerned with the study of how characteristics are passed on from parents to offspring.

3. The unique code for your genetic make-up is stored in the nucleus of every cell in your body.

4. Your body is composed of about 10 trillion cells. In each cell is a nucleus containing chromosomes. Each chromosome consists of double-helix shaped molecules of DNA. The DNA is divided into segments called genes. The genes contain the genetic information that determines the traits you inherit.

5. DNA is in the shape of a twisted ladder. Each rung of the ladder is made up of base pairs. Each molecule of DNA is made up of about three million base pairs.

6. The genes are made up of different arrangements of the base pairs. The arrangement of the base pair determines the traits you inherit.

7. a. There are 46 chromosomes arranged in 23 pairs in each human body cell.

   b. Each parent provides 23 chromosomes.

8. a. Scientists organize the chromosomes into pairs by size, beginning with the longest pair. The sex chromosomes are placed in the organization last.

   b. The combination of X and X chromosomes or X and Y chromosomes determines the sex of the baby.

   c. The sex chromosome combination for human females is XX and XY for human males.

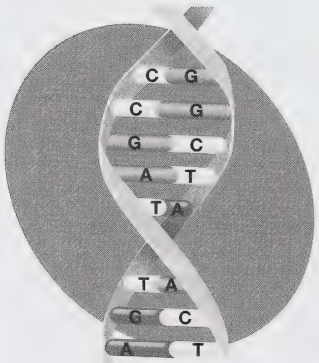
9. Scientists take a photograph of chromosomes in white blood cells. They then use the photograph to make up a chromosome map.

10. Only 0.1% of your DNA is different from that of another person. However, that 0.1% is what makes you unique.

11. **Textbook questions 2, 3, and 4 of "Check Your Understanding," p. 215**

    2. cells → nucleus → chromosomes → DNA → genes

    3. Your drawing should show the twisted sides and eight base pairs. Guanine (G) is paired with cytosine (C), and adenine (A) is paired with thymine (T).



    4. a. Humans have 23 chromosome pairs.

       b. A male has an X and a Y chromosome. A female has two X chromosomes.

Section 4: Lesson 2

1. a. Tall parent pea plants crossed with tall parent pea plants produced tall offspring pea plants.

   b. Short parent pea plants crossed with short parent pea plants produced short offspring pea plants.

   c. Tall parent pea plants crossed with short parent pea plants produced tall offspring pea plants.

   d. Tall hybrid pea plants crossed with tall hybrid pea plants produced both tall and short offspring pea plants.

2. Mendel called the tallness trait dominant because it seemed to dominate over the shortness trait. Mendel called the shortness trait recessive because it seemed to disappear. (The offspring were tall when tall parents were crossed with short parents.)

3. Mendel concluded that tallness must be controlled by factors inherited from both parents.

4. Geneticists use capital letters to represent dominant genes and lower case letters to represent recessive genes.

5. Only one gene for each trait is passed on from each parent because each sperm cell or egg cell contributes only one chromosome.

6. A Punnett square is a method of showing the possible results of crossing genes from each parent.

7. The Punnett square shows there is only one combination that results in two recessive genes in the offspring. The other three combinations have at least one dominant gene.

8. None of the offspring in Punnett square C would be short since all four combinations have one dominant gene.

9. The chances of having an attached earlobe is 1 out of 4, or 25%.

10. **Textbook question "Reading Check," p. 217**

    Three genotypes are CC, Cc, and cc.

11. **Textbook question "Try This!," p 217**

    Your Punnett square should be similar to the following.

	X	**X**
X	XX	XX
Y	XY	XY

    The chances of the offspring being male is 2 out of 4, or 50%. The chances of the offspring being female is 2 out of 4, or 50%.

12. The daughter has the same trait as the father.

13. The two sons inherited the gene for the lack of the specific trait from their mother.

14. In order for the daughter to have both recessive genes, she had to get one from her father and one from her mother. Therefore, the mother had to have the recessive gene. Also, in order for the sons to have one dominant gene and one recessive gene, the mother had to have a dominant gene as the second gene. The father has no dominant gene for earlobe attachment to pass on.

15. No, each child has a 50% chance of being Ee and a 50% chance of being ee. The fourth child could have either genotype for earlobes.

16. **Textbook questions 1, 2, and 3 of "Check Your Understanding," p. 219**

    1. You inherit characteristics, such a eye colour, from you parents by getting either a dominant gene or a recessive gene from each parent. You can get either two dominant genes, one dominant gene and one recessive gene, or two recessive genes. This depends on which genes your parents have. If you have at least one dominant gene for the trait, you will have that trait.

    2. A Punnett square is a useful tool because it can be used to predict the probability of offspring inheriting traits from their parents.

    3. No, both plants with genotype TT and genotype Tt will look the same. Only one gene for tallness is required for the tallness characteristic to be present.

Section 4: Lesson 3

1. A mutation is an abnormal gene.

2. Gene **a** has one base pair that is interchanged when compared to gene **A**. One base pair for gene **a** is TA while the same base pair for gene **A** is AT.

3. A mutagen is an environmental factor that causes mutations.

4. Four examples of environmental factors that may cause mutations are radiation; ultraviolet light; PCBs; and chemicals in cigarettes, alcohol, and drugs.

5. **Textbook question a., b., and c. of "Try This!," p. 220**

a.

	A	**A**
A	AA	AA
a	Aa	Aa

There is a 0% chance of these parents having offspring with sickle-cell anemia.

b.

	A	**a**
A	AA	Aa
a	Aa	aa

There is a 1 out of 4, or 25%, chance of these parents having offspring with sickle-cell anemia.

c.

	A	**a**
a	Aa	aa
a	Aa	aa

There is a 2 out of 4, or 50%, chance of these parents having offspring with sickle-cell anemia.

6. a. Two out of four, or 50%, of the offspring are carriers of sickle-cell anemia.

   b. Three out of four, or 75%, of the offspring are either carriers of sickle-cell anemia or have the disease.

   c. All four, or 100%, of the offspring are either carriers of sickle-cell anemia or have the disease.

7. People with sickle-cell anemia have a poor resistance to infection and have low levels of iron in their blood.

8. An inherited mutation might be beneficial when the mutation results in a desirable characteristic. One example is the long neck of giraffes. Giraffes with a mutation for long necks will have an increased ability to reach food and, therefore, have a better chance of survival.

9. Radiation from X-ray machines and ultraviolet light can cause mutagens.

10. Radiation can be beneficial when it is used to treat diseases, such as cancer.

11. The human embryo is most at risk to exposure to mutagens.

12. Exposure to alcohol, exposure to prescription and illegal drugs, and PCBs are mutagens especially harmful to human embryos. You should have had any two of the effects for each mutagen given on page 222 of the textbook.

13. Answers will vary. Sample results are given. The assumed class size for these results is 20. **Note:** Some seeds did not germinate and few green seed plants died. Total seeds at start is 20 for individual and 200 for class.

TABLE 1

Lighting	Green Seed Totals	Albino Seed Totals	Green Seed Class Totals	Green Seed Class (%)	Albino Seed Class Totals	Albino Seed Class (%)
dark	7	3	141	71	57	29
light	8	2	157	79	38	19

TABLE 2

Lighting	Green Seed Totals	Albino Seed Totals	Green Seed Class Totals	Green Seed Class (%)	Albino Seed Class Totals	Albino Seed Class (%)
dark	7	0	140	70	0	0
light	7	0	152	76	0	0

14. **Textbook questions 2, 3, and 4 of "Conclude and Apply," p. 221**

    2. An albino seed has no chance of survival beyond initial germination.

    3. The green seed plants that were in the dark became greener after they were put in the light for a few days.

    4. Yes, the results agree with this statement. The green seeds that sprouted became greener when placed in the light. The albino seeds had no colour when germinated in either dark or light conditions and did not survive when placed in the light.

15. Both heredity and environment are important for survival of a plant. Without the proper genes, the plants could not survive. Also, without light, the plants cannot survive.

16. **Textbook questions 1 and 3 of "Check Your Understanding," p. 222**

    1. When chromosomes are copied, mutation may occur if the code in a base pair is incorrect. The code in the base pair of a mutated chromosome may be interchanged compared to the base pair code in the normal chromosome.

    3. Pregnant women should avoid the consumption of alcohol or drugs during their pregnancy because an embryo is especially sensitive to the harmful effects of these mutagens.

Section 4: Lesson 4

1. The human genome is all of the genes found in a complete set of chromosomes.

> **Note:** There are about 30 000 genes in a complete set of human chromosomes with about 3 billion base-pair combinations.

2. Genetic engineering involves the transfer of genes from one organism to another.

3. Scientists inserted a spider gene into goats, which then produced the protein found in spider silk in their milk. Scientists remove the protein from the goat's milk and use it to produce silk fibres used to make bulletproof vests.

4. Genetic research can be used to check the chances of a person getting the disease, especially when his or her family has a history of the disease.

5. Amniocentesis is a procedure used to determine the chromosomal make-up of a fetus. The test can be used to show whether or not the fetus will have a genetic abnormality.

6. Benefits of genetic research include

    - identifying the source of thousands of genetic disorders, such as colour blindness, hemophilia, cystic fibrosis, and epilepsy
    - developing new drugs and treatments for diseases, such as those to treat diabetes
    - helping people make lifestyle choices by studying genes of people with a genetic make-up toward certain diseases

7. An ethical question is about what is right and what is wrong.

8. An insurance company may want to charge higher rates or even deny insurance coverage to a person with a genetic make-up that may result in a higher chance of developing certain diseases.

9. Answers will vary. You may want to know so you can seek the most treatment possible at the earliest stage possible. You may not want to know as it may causes needless worry over a long period of time, particularly if you never develop the disease.

10. A benefit of genetic research would be to find new ways of treating or curing existing diseases.

11. Answers will vary. Your paragraph should support one of the positions. The following are some sample points you may have included in your paragraph.

    Position: The scientist should not be cloned.

    - The clone would have the same genetic make-up and may get the same disease.
    - It is unfair to expect the clone to carry on with the work of the scientist.
    - The clone may have a different personality and may not enjoy that type of work.
    - The clone may not gain the necessary knowledge to carry on the scientist's work.
    - Mistakes can happen in the cloning process resulting in problems for the clone or resulting in the clone passing on genetic mutations to future generations.

Position: The scientist should be cloned.

- Scientists should use whatever technology is available to advance science.
- It is difficult to learn more about cloning if it is not allowed.
- More knowledge about cloning may benefit all humans.
- A cure may be found for the scientist's disease and could be used to cure the clone if the disease develops.

12. **Textbook questions 3 and 4 of "Extend Your Skills," p. 224**

    3. Answers will vary. Cloning might be acceptable if it helps advance scientific knowledge and benefits all humans by providing ways of preventing or treating diseases.

    4. a. Answers will vary. You may say it is valuable if undesirable traits could be eliminated. However, you may consider it unethical to consider certain traits are better than others. If only certain traits are chosen, genetic variation will be lost after an extended period of time. Who will decide which trait should be selected—parents, scientists, or government?

       b. Genetic engineering may be the only way to treat some diseases. Preventing inherited diseases from carrying on to future generations would reduce the cost of health care for future generations. Arguments against using genetic engineering might include the possibility of misuse for purposes other than eliminating disease and that society needs to accept and value differences between people.

13. Scientists believe stem cells can be used to treat diseases like Alzheimer's, Lou Gehrig's disease, cancer, and even baldness.

14. Legislators are battling over whether or not to allow stem-cell research because it involves human embryos. Many people feel that the human embryo stage is the beginning of human life and should not be destroyed.

15. **Textbook questions 1 and 2 of "Check Your Understanding," p. 225**

    1. Amniocentesis can be used to determine if a fetus has a genetic abnormality. Parents may use the test to decide whether they should continue with the pregnancy. People who oppose abortion feel that such a test should not be used.

2. Answers will vary. You may have had some of the following points in your list.

Pro	Con
• Doctors and other health-care providers are obliged to respond to the needs of their patients. • New drugs and treatments can be developed. • Genetic disorders can be identified. • Genetic information will help people make informed decisions.	• Techniques might be misused for uses other than curing disease. • Scientists do not know all the risks of genetic research. • Knowing that your genetic make-up is prone to certain disease may cause depression. • Employers may be hesitant to hire anyone with certain genetic make-ups. • Health insurance companies may want to charge higher premiums or deny coverage for those with certain genetic make-ups.

Section 4 Review

1. **Textbook question 1 of "Reviewing Key Terms," p. 226**

1. a. The nucleus of each cell contains **chromosomes**.

   b. The study of how traits are passed from parents to offspring is called **genetics**.

   c. Mutations in the DNA result in **genetic disorders**.

   d. The basic building block of an inherited trait is called a **gene**.

   e. Down syndrome is a genetic disorder. Genetic disorders can be detected with a test called **amniocentesis**.

   f. An abnormal change in genetic information results in a **mutation**.

g. A trait that remains hidden for several generations is called a **recessive** trait.

h. Mendel used pea plants to study **heredity**.

i. The method often used to trace patterns of inheritance in a family is the **pedigree**.

j. A **purebred** has identical genes for each trait.

k. Genes consist of arrangements of base pairs in the **DNA** molecule.

l. Plants that carry one gene of each kind for a trait are called **hybrid** plants.

2. **Textbook questions 3, 4, and 7 of "Understanding Key Ideas," p. 226**

3. a. and b. Answers will vary. The following table shows a number of traits you may have inherited and indicates which traits are dominant and which are recessive.

Trait	Dominant Trait	Recessive Trait
dimples	dimples	no dimples
earlobe	detached	attached
eye colour	brown/green	blue/grey
feet	arched	flat footed
hair colour	brown/black	blond/red
second digit finger	short	long
skin pigment	freckles	no freckles
tongue	can roll	cannot roll
thumb	bends back	does not bend back

4. A physical trait can appear to skip a generation when it is the recessive trait and is covered by the dominant trait.

7. Genetic engineering helps people with diabetes because it has been used to produce an inexpensive supply of insulin.

3. **Textbook question 8 of "Developing Skills," p. 227**

8. a. Human sex chromosome pairs are made up of X chromosomes and Y chromosomes. Females have two X chromosomes and males have an X chromosome and a Y chromosome. Human offspring receive one sex chromosome from each parent. So the offspring may receive an X chromosome from each parent, making the offspring female; or the offspring may receive an X chromosome from the mother and a Y chromosome from the father, making the offspring male.

b.

		Mother	
		X	**X**
Father	**X**	XX	XX
	Y	XY	XY

c. The chances of having a female offspring is 2 out of 4, or 50%. The chances of having a male offspring is 2 out of 4, or 50%.

4. **Textbook questions 11 and 12 of "Problem Solving/Applying," p. 227**

11. No, if each has the recessive gene as well as the dominant gene, chances are 1 out of 4, or 25%, that the offspring will have straight hair. The following Punnett square shows how this works.

	C	**c**
C	CC	Cc
c	Cc	cc

12. Answers will vary depending on which traits you selected for the parents. The following is an example.

a. and b. **Nimar**

- curly hair with recessive gene; genotype Cc
- freckles with recessive gene; genotype Ff
- short eyelashes with no recessive gene; genotype ee

Sue

- straight hair with no recessive gene; genotype cc
- freckles with no recessive gene; genotype FF
- long eyelashes with no recessive gene; genotype EE

c. The following Punnett squares show the possible combinations for each trait.

Curly Hair

Sue \ Nimar	C	c
c	Cc	cc
c	Cc	cc

Freckles

Sue \ Nimar	F	f
F	FF	Ff
F	FF	Ff

Eyelashes

Sue \ Nimar	e	e
E	Ee	Ee
E	Ee	Ee

d. The chances of the baby having curly hair is 2 out of 4, or 50%. The chances of the baby having freckles is 4 out of 4, or 100%. The chances of the baby having long eyelashes is 4 out of 4, or 100%.

5. **Textbook question 14 of "Critical Thinking," p. 227**

14. Answers will vary. The following are some possible concerns people may have about cloning humans:

- Cloning is not fail-proof, and some fetuses may die before cloning methods are perfected.
- Some people may want to clone specific people (e.g., athletes, movie stars, and brilliant scientists).
- Some people may want to clone for the purpose of harvesting body parts. This may be considered unethical.
- Cloning may violate the rights of an individual.
- Genetic mutations may be passed on to future generations more often if people with mutations are cloned.
- Who decides who is to be cloned?
- Psychological effects of cloning on families and individuals are unknown.

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21 © 2003–2004 www.clipart.com (world); EyeWire Collection/Getty Images (teacher)

22 PhotoDisc Collection/Getty Images

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28 PhotoDisc Collection/Getty Images

29 **main:** Corel Corporation
banner: PhotoDisc Collection/Getty Images (sign, vaccine, and produce)

30 PhotoDisc Collection/Getty Images

31 PhotoDisc Collection/Getty Images

32 Digital Vision/Getty Images

33 © 2003–2004 www.clipart.com (garbage can); EyeWire Collection/Getty Images (teacher)

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39 EyeWire Collection/Getty Images (students)

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41 **main:** Brendan Byrne/Digital Vision/Getty Images
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42 Brand X/Getty Images

43 PhotoDisc Collection/Getty Images (bandaging a finger); © 2003–2004 www.clipart.com (bacteria)

44 PhotoDisc Collection/Getty Images (teacher); © 2003–2004 www.clipart.com (syringe and vaccine)

45 EyeWire Collection/Getty Images

46 EyeWire Collection/Getty Images

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51 EyeWire Collection/Getty Images (immunization); © 2003–2004 www.clipart.com (flower)

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53 EyeWire Collection/Getty Images

54 PhotoDisc Collection/Getty Images

55 PhotoDisc Collection/Getty Images

58 EyeWire Collection/Getty Images

59 PhotoDisc Collection/Getty Images

60 **main:** PhotoDisc Collection/Getty Images
banner: PhotoDisc Collection/Getty Images (DNA, mouse, and scientist)

61 PhotoDisc Collection/Getty Images

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71 PhotoDisc Collection/Getty Images

73 EyeWire Collection/Getty Images

74 EyeWire Collection/Getty Images (teacher); PhotoDisc Collection/Getty Images (mouse)

75 PhotoDisc Collection/Getty Images (blood samples); EyeWire Collection/Getty Images (teacher)

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78 PhotoDisc Collection/Getty Images (scientist); EyeWire Collection/Getty Images (teacher)

79 EyeWire Collection/Getty Images

80 EyeWire Collection/Getty Images

81 **main:** PhotoDisc Collection/Getty Images
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